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AN ESSAY ON THE HISTORY OF LOCKJAW *

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In these days of extraordinary activity in medical-historical studies early writings dealing with nearly all of the common diseases, particularly those whose etiology has been discovered, are critically examined and interpreted in the light of modern concepts. A careful search reveals, however, that in the past twenty-five years practically nothing has been done in the way of appraising the ideas of antiquity concerning the frightful malady known as lockjaw or tetanus. This is perhaps not surprising, since the historical studies of Rose and Graumann, published soon after the discovery of the tetanus bacillus, and the writings of many distinguished investigators, including Brunner, Meyer, Behring and others, provided an evaluation of the older literature that appeared to be adequate for many years to come. Recently, however, as the result of researches conducted by Abel and his collaborators, our ideas of the pathogenesis of tetanus and our understanding of its manifold symptoms have been greatly clarified. This work has necessitated abandon-

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ment of the time-honored Meyer-Marie hypothesis which assumed that all of the manifestations of tetanus resulted from the action of tetanus toxin upon the motor centers of the spinal cord and medulla, and that the poison was carried to these nuclei within motor nerves, the terminals of which were supposed to absorb the toxin from the wound. The theory, first conceived by Zupnick, and now firmly supported by the experimental studies of Abel, is put forward that tetanus toxin has a dual action, the results of which are, first, a lasting rigidity of striated muscles caused by direct poisoning of the motor end-organs, and second, tonic and clonic spasms or convulsions due to impulses emanating from the motor nuclei of the neural axis, which have been rendered hyper-excitable by toxin conveyed to them solely by the blood stream. This is not the place to defend Abel's theory; nevertheless it should be borne in mind that its two chief tenets—the dual action of a drug and its transport along the blood vascular pathways—violate no principles of physiology or pharmacology, but simply assign to tetanus toxin a logical place in the hierarchy of poisons, refusing to endow it with the mysterious and unique capacity to climb up motor nerves. A careful study of the available evidence reveals that the assumption of a dual rôle for tetanus toxin, far from violating (as Topley and Wilson believe)[1] Ockham's precept, "entia non multiplicanda sunt praeter necessitatem,"[2] gives a closer approximation to the truth, like the calculation of the value of π to additional decimal places. Quite aside from its physiological implications the work of recent years has stimulated more accurate and detailed bedside observations of the complex symptoms of tetanus with particular emphasis on the localized or partial forms of this disease.[3] Thus it has come about that we can better appreciate the descriptions of tetanus that have become our heritage; many of the ancient accounts assume a new significance and

[1] *Principles of Bacteriology and Immunity*, Second Edition, London, 1936, page 1390.

[2] Allbutt (*Greek Medicine in Rome*, pp. 98 note 1, 155) has pointed out that this principle of the economy of causes was probably first enunciated by Theophrastus in his treatise "De Sensibus," and later stated by Aristotle in "De Partibus Animalium": *οὐδὲν γὰρ ποιεῖ περίεργον ἡ φύσις* (Nature does nothing in vain) "which sentence was the immediate origin of Ockham's 'Razor.'"

[3] See Abel, J. J. and Chalian, W. Researches on Tetanus. X. Local Tetanus, (To be published in the *Bulletin of the Johns Hopkins Hospital.*)

and not a few of them excite our admiration because of their accuracy and vividness. Let us therefore turn back the pages of medical history and consider one by one the ideas entertained in regard to lockjaw.

I. The Pre-Hippocratic Period

It need occasion no surprise that our search takes us to the very first page of medical history, the venerable Edwin Smith Surgical Papyrus, written about 1500 B. C. and, according to its translator (Breasted), probably copied from a much older manuscript, dating back to 3000 B. C. For tetanus is probably at least as old as the human race, the infecting spores not being dependent for their perpetuation upon the presence of a host and capable of lying dormant in the earth, if need be, for centuries. Case 7 of this document presents certain features which are suggestive of tetanus, but which do not by any means provide a satisfactory clinical picture. Unfortunately, the " case " does not represent a series of events that befell a specific person but is rather a discussion of the treatment of head injuries. It is plain that the description given is that of a person who has suffered a compound fracture of the skull, doubtless caused by a blow: " A gaping wound in his head, penetrating to the bone and perforating the sutures of his skull; the cord of his mandible is contracted; he discharges blood from both his nostrils and from both his ears, while he suffers with stiffness in his neck." The presence, at this obviously acute stage, of difficulty in opening the mouth and cervical rigidity must be explained on some other basis than tetanus, which is always preceded by an incubation period of several days. Intracranial hemorrhage and local injury to the jaw would satisfactorily account for these symptoms, and the yielding of the trismus to hot applications tends to support this idea. However, the second examination, made presumably a day or so later, postulates that " his mouth is bound and both his eye brows are drawn, while his face is as if he wept." These symptoms together with " stiffness in his neck " would point strongly to the development of tetanus, provided only that the requisite incubation period has been observed—a circumstance that can be determined neither from the text nor the glosses. The final bit of evidence in support

of the diagnosis of tetanus is found in the " third treatment," which enjoins the reader to " have made for him a wooden brace padded with linen and put into his mouth," a measure evidently resorted to because of the enduring character of the jaw symptoms.[4] Further treatment consists in giving the patient a draught made of a certain variety of fruit and maintaining him in a sitting position between two supports of brick " until thou knowest that he has reached a decisive point." Thus it may fairly be inferred that the patient was granted a chance of recovery from what was to all intents an attack of tetanus following a head injury. It is precisely here that Professor Breasted finds himself in difficulties, for he states that, according to Dr. Simon Flexner, once tetanus infection reaches the brain the patient cannot recover. It seems possible, though by no means certain, that the brain was exposed to direct infection, for the description reads, " one having a gaping wound in his head penetrating to the bone and piercing the sutures of the skull." Even if we assume that the tetanigenous wound was in the meninges or the brain itself, it does not necessarily follow that such an infection would lead to death. The neural transmission hypothesis, which incorporates such a belief, has lately been shown to be based upon defective experiments; not only can tetanus infection involve the brain without inducing a fatal tetanus, but such an infection can occur without the production of symptoms, provided that but a fraction of a lethal dose of toxin is elaborated. The hypothetical case of our Egyptian preceptor may therefore justifiably be construed as a severe head injury followed by tetanus from which the patient may or may not recover.

Mention of tetanus is found in other ancient medical treatises, the oldest of which, next to the Egyptian Papyrus, seems to be the work of the Hindu physician Sushruta (600 B. C.?). We need not tarry long over the fanciful descriptions given by this author, who believed that tetanus (Dhanushtambha) was caused by the enraged Vayu (nerve force) which bent the body like a bow, but who recognized its characteristic symptom to be " a paralysis of the jaw bone." Scarcely less fanciful are the views entertained by the early Chinese

[4] Ambroise Paré, many centuries later, employed a much more efficient mechanical device to force the jaws apart.

physicians, who, according to Yü, fully described tetanus in a book entitled "Huang Ti Nai Ching" (409-247 B. C.). The disease was ascribed to the entrance of wind into an open wound, a belief that was long afterward resurrected in the literature of other countries. "Hence," writes Yü, "the term *Po Shang Feng*, meaning 'wind in an open wound,' was used for the disease in the ancient Chinese medical books and has been adopted as the technical term by the modern Chinese and Japanese medical world." The patient afflicted with lockjaw was given a decoction of *Ke Keng Tang* and of *Pachyrhizus* and *Thunbergismus* and subjected to needling, just above the ears for trismus and over the spine in cases of opisthotonos. Similar practices were later employed by the Arabs.

II. Hippocrates on Tetanus

Interesting as these references to tetanus are, they pale into significance when compared with the excellent descriptions found in the Hippocratic treatises, descriptions so accurate they can scarcely be amended today. A fresh study of the Hippocratic casuistics of tetanus and ideas concerning its etiology, treatment and prognosis, rewards us with findings that are truly exciting, particularly since the true significance of some of them appears not to have been grasped before. It is in the works of Hippocrates that the nomenclature of tetanus is first encountered. The word τέτανος (derived from the verb τείνω meaning to stretch) had then a somewhat different meaning from that which it possesses today, being employed both in a generic and specific sense. For instance, the plural form οἱ τέτανοι is encountered in the treatise on *Internal Affections*, where the statement is made that there are "τέτανοι τρεῖς." The first of these is τέτανος, which often results from a wound: "The jaws become rigid and the patient cannot open his mouth, the eyes water and are drawn, the back is rigid, and neither the arms nor the legs can be bent." In the second type the body is bent backward owing to implication of the posterior tendons of the neck, an affection termed ὀπισθότονος, from ὀπισθε, backward, and τείνω. The third type is ἄλλος τέτανος, literally, "another tetanus," less dangerous than the preceding. The words *emprosthotonos* and *pleurosthotonos*, which do not appear in the Hippocratic corpus, were mentioned much later

by Aretaeus and Boenneken, respectively. The Hippocratic statements concerning tetanus are surprisingly free from speculation as to the etiology of this condition, such ideas as are expressed depending upon actual observation of causal relationships. Thus, it is observed that the malady may be the result of a wound or a blow on the neck; in one instance, the first actual clinical record of tetanus in medical literature, the disease followed a surgical operation. This case history, which appears in the fifth book of *Epidemics*,[5] is unrivaled in the annals of tetanus for accuracy and conciseness. More remarkable still, it is an example of the most complex form of the disease known, namely combined local and general tetanus, a syndrome that has only relatively recently achieved general recognition.

> The hip of Scamander, in Larissa, was affected by gangrene and the bone sequestered after a long time. A large incision was made down to the bone and a cautery was applied. On the twelfth day after the incision was made increasing spasms set in. The leg was drawn up to the ribs and the spasm passed over to the other side. The leg was flexed and extended; it set in motion the other parts. The jaws were fixed. The man died in a state of convulsion on the eighth day after the onset of the spasm. He was treated over the whole body with fomentations, applied by means of leather bags, and with embrocations made with lentils. An enema was administered, which yielded a small amount of old feces. He drank the dark purgative, which evacuated something, but obtained no help from the medicine. He slept little, and toward evening drank again the potent dark purgative; he died at sunrise. It seems that he would have lasted a longer time had it not been for the strength of the purgative.

The patient probably suffered from osteomyelitis of the hip which was incised and cauterized. Twelve days after the operation spasm set in and the leg was drawn up to the ribs, a manifestation which, in view of what happened later, can safely be interpreted as local tetanus.

I may digress for a moment to state that according to present conceptions, local or partial tetanus can only be due to direct poisoning of muscles adjacent to a wound; the poisoned muscles are contracted, the position of the part affected being determined by the relative tensions of the normal and tetanic muscles. In the case of Scamander the net result of these forces was flexion of the thigh upon the abdo-

[5] Littré's Hippocrates, Vol. V, p. 215.

ment. It is of great interest that the spasm should have spread to the opposite side, for this is a very rare occurrence in the natural disease, although it can be produced with ease experimentally. " The leg was flexed and extended; it set in motion the other parts " undoubtedly refers to participation of the extremity in convulsive movements, probably of a clonic type. Similar observations were made by Baron Larrey centuries later. That the general convulsions of tetanus often begin in the injured extremity has been noticed by many observers since this description was written. The sentence, " The jaws were fixed," removes all doubt as to the diagnosis. The statement that the patient died on the eighth day after the onset of the spasm affords further proof that the observer attached a good deal of significance to the manner of onset of the illness—with spasms—and this is particularly worth mentioning, for localized spasm as a harbinger of tetanus has often been overlooked. Indeed, Edmund Rose went so far as to deny the reality of this symptom, and any other " Vorboten," of tetanus.

As to the treatment applied to Scamander, it may be remarked that the fomentations and embrocations and the use of purgative drafts were at least rational; the physician's purpose being to correct the repletion which supposedly affected his patient. Most praiseworthy is the candour of the physician, who suggests that his medicine might have been responsible for the fatal issue.

It is singular that so important a contribution to the study of tetanus has not attracted more attention. Trnka de Krzowiz, in his treatise, *De Tetano* (1777), cites this case as an example of postoperative tetanus, while Campet is satisfied merely to quote the passage without comment.[6]

In the fifth book of *Epidemics,* which is so rich in objective data bearing upon a variety of disorders, one finds several additional examples of tetanus. An instance is cited of a man who received as a result of a javelin thrust a superficial wound at the base of the neck.[7] Opisthotonos soon appeared together with rigidity of the jaws; the patient, unable to swallow even liquids, which returned through the nose, succumbed on the second day. Another fatal case

[6] *Traité Pratique des Maladies Graves.*

[7] Littré's Hippocrates, Vol. V, Epidemics V, Sections 47, 74 and 75.

of tetanus resulted from an injury to the index finger.[8] The index finger of the captain of a large vessel was crushed by the anchor. Inflammation and gangrene set in and a portion of the finger came away. A week later the patient complained of difficulty in swallowing, which led the physician to prognosticate opisthotonos. In due course the jaws became fixed and the neck was stiffened. Finally, on the third day, the body was bent backward and a sweat broke out. Death occurred on the sixth day.

We next come upon the sad history of Telephanos,[9] the son of Halpalus, who sprained his thumb; inflammation and pain set in, but the part recovered. Some time later, however, the jaws became locked and opisthotonos appeared; death occurred on the fourth day. Thrumion, the son of Damon, sustained a wound of the ankle adjacent to a tendon;[10] the medicaments applied having irritated the wound, fatal opisthotonos supervened. Here again, as in the first case, the physician acknowledges that his treatment was ill-advised, for it led to the development of tetanus.

The last example of tetanus cited in *Epidemics V*[11] is less clearly defined than the preceding ones. Tychon, wounded by a missile hurled by a catapult, was seized soon afterward with noisy laughter. "It seemed to me," remarks the author, who, as Littré suggests, probably acted in the capacity of consultant or assistant to the physician in charge, "that the doctor who extracted the piece of wood left a portion of the lance in the diaphragm." In the evening, the patient being in pain was bathed and given a purgative, but he continued to suffer throughout the night. The next day, however, the physician and the others considered him very much better but the consultant predicted that spasms would set in, which would subsequently lead to death. The following night the patient was still uncomfortable and unable to sleep. On the morning of the third day he was taken with spasms and soon afterward died. One cannot be certain as to the nature of the illness that carried off Tychon; inadequate information is offered as to the incubation period and the nature of the spasms. If however, we take the expression γέλως . . . θορυβώδης, which Littré translates, *rire pleine de trouble*, to

[8] *Ibid.*
[9] *Ibid.*
[10] *Ibid.*, Epidemics V, Sections 76 and 95.
[11] *Ibid.*

signify what later came to be known as risus sardonicus, a manifestation pathognomonic of tetanus, our task is immediately simplified, for although the incubation period is indefinite, the disease is given three days to induce the death of the patient, which agrees quite well with clinical experience. On the other hand, it might be argued that this new view does not square with the facts, that the patient died of some other condition.

Having thus briefly examined the actual instances of tetanus as recorded in *Epidemics*, we may now describe the various treatments recommended in the Hippocratic writings and also the interesting prognostic criteria.[12] Among the chief measures to be adopted in treating tetanus are bleeding, the use of strong wines to promote sweating, rubbing the affected parts with ointments, bathing the limbs in warm water, after which the body is to be carefully wrapped leaving only the hands and feet exposed, the trunk being wrapped in oil-soaked cloths. The patient is not to be purged and clysters are to be administered only when there is prolonged constipation. If the patient improves, all is well; if not, make a brew of the root of *bryony* [13] and *cretan demus* [14] and give the patient some of this infusion before breakfast. He should then eat as much warm porridge as possible and may drink as much wine as he wishes. If he responds to this, it is a good sign; if not, the outlook is gloomy.[15] In the treatise on *Diseases* (Book III)[16] pills of pepper and black hellebore are recommended, and warm fatty broth of fowl. One should prescribe vapor baths and make warm, moist applications to the parts affected by pain. Hippocrates advocates the use of heat, provided both externally and internally; affusions of water, cataplasms, and embrocations are all to be warm, and all food is to be heated or productive of warmth. Hydromel, a mixture of honey and water, is to be given by mouth. If this is impossible of attainment the food

[12] In regard to etiology, it was early recognized that while many instances of tetanus could be related to a definite wound or trauma, as in the cases cited above, there were others that could not be traced to any injury. Thus spasm was occasionally observed to follow childbirth or exposure to cold.

[13] An active hydragogue cathartic.

[14] Probably wild carrot, possessing strong diuretic qualities.

[15] Littré's Hippocrates, Vol. II, p. 469.

[16] *Ibid.*, Vol. VII, p. 132.

is to be administered intranasally. It was recognized that the majority of the external remedies acted by inducing sleep, which always mitigates the spasm of tetanus.

Many aphorisms are concerned with prognosis. For the most part the criteria given may be accepted as valid. There are, however, two outstandingly erroneous generalizations which have been singled out by many commentators, the majority of whom have completely overlooked the general excellence of the Hippocratic contributions to tetanus. The first of these statements is that the appearance of fever in patients stricken with tetanus is to be regarded as a favorable sign, dissipating the malady.[17] It has been known for many years that the opposite is true. The second erroneous statement reads, " Those who are seized with tetanus die in four days; if they survive the fourth day they will recover." [18] This aphorism is contradicted in Book III, in the treatise *On Diseases*, where it is observed that the patient may succumb on the third, fifth, seventh or fourteenth day.[19] This evident contradiction is perhaps to be explained on the assumption that the two statements were made by different physicians, each of whom attempted to generalize on the basis of a limited personal experience. Certainly in that day there existed no efficient means of comparing notes with one's colleagues.

Before concluding our discussion of the Hippocratic views on tetanus let us consider briefly the variety termed ἄλλος τέτανος, a form less dangerous than the other two (τέτανος and ὀπισθότονος), which is stated to arise from the same causes as the other types but is often induced by a fall on the back: [20] " The patient suffers in the following way: the entire body is in spasm; sometimes, however, any one part of the body is seized with spasm. At first the patient is able to wander about, but in the course of time he takes to his bed and again the suffering and the spasm abate." This bit of evidence tends to show that Hippocrates was acquainted with local tetanus. We must of course refrain from reading into this sentence something that is not there; yet when the statement " ἐνίοτε δὲ καὶ ὅκῃ ἂν τύχῃ τοῦ σώματος σπᾶται . καὶ περιφοιτῇ μὲν το πρῶτον " is taken in conjunction with the

[17] Aphorisms IV, 57.
[18] Aphor. V, 6.
[19] Littré's Hippocrates, Vol. VI, p. 132, 133.
[20] Littré's Hippocrates, Vol. VII, pp. 299-303.

remarkable history of Scamander, cited above as an undoubted instance of combined local and general tetanus, where the spasms were certainly observed to have originated in the part that harbored the wound, and when we add to this the fact that not a single discordant note is found in the Hippocratic casuistics of tetanus, it does not seem to be straining the bounds of credulity to presume that the "Oracle of Cos" and his followers were keen enough to recognize some of the atypical forms of tetanus, which they placed in the category of "ἄλλος τέτανος."[21] The aggravation of symptoms when the patient gets up and walks about in this modified form of the disease is well described: "At first the patient walks about, then as the disease progresses he takes to his bed. The suffering and spasm abate. Then perhaps he may get up again and walk for several days, when he will find himself in the same difficulties." The exacerbating influence of physical exercise upon the manifestations of incipient tetanus was not described again until the nineteenth century.

One can almost say that practically nothing of importance was added to the teaching of the Hippocratic school with regard to tetanus, until Carle and Rattone in the year 1884 proved the infectious nature of the disease by inoculating rabbits with pus taken from a furuncle on the face of a patient that died of tetanus. The sayings of Hippocrates continued to be quoted for centuries, and in general physicians treated their patients according to his precepts. Our judgment respecting the merits of the Greek physicians and their successors can only be based upon purely objective data which they supplied and not upon their ideas of the etiology of the disease or even its treatment, for only that which they truly perceived with the five senses and committed to writing is of lasting value. In the case of tetanus their observations square with those made today.

III. The Graeco-Roman Period

After Hippocrates there appeared a host of writers who added very little to the stock of knowledge concerning tetanus. It is often difficult to determine whether these writers actually observed the

[21] Bilfinger (De tetano, p. 9) regards "ἄλλος τέτανος" as ordinary epilepsy; "Quis non dicet Epilepsiam?" Doubtless, so diverse a group of symptoms as that embraced by this term can be made to fit several diseases.

disease, for they gave no case histories and oftentimes their descriptions contain elements that cannot be fitted into the disease picture as Hippocrates depicted it and as we know it today. Even though deficient in originality, their accounts are not entirely devoid of interest, for often they contain certain points that had not been emphasized previously, and often a therapeusis that is ingenious and rational. The first of the compilers was Celsus, who lived a few decades before the beginning of the Christian era. Celsus' reputation is founded chiefly upon the purity of his Latin, which prompted Samuel Johnson to remark, "I would bear something rather than Celsus should be detected in an error." [22] His great service was to preserve in a palatable form the medical lore of antiquity, in the celebrated work *De Medicina*. Of tetanus he wrote, "No disease . . . more distressing and more acute than that which by a sort of rigor of the sinews now draws down the head to the shoulder blades, now the chin to the chest, now stretches out the neck straight and immobile. The Greeks call the first *opisthotonos*, the second *emprosthotonos* and the third *tetanos*." In this passage we encounter for the first time the term *emprosthotonos*, an exceedingly rare variety of tetanus, so rare, indeed, that many have denied that it ever occurs. Since it is not mentioned in the Hippocratic treatises it seems reasonable to suppose that the term was probably invented by writers of a later period for the sake of a symmetrical nomenclature, as a complement to the term *opisthotonos*. Perchance they reasoned that if at times the neck is bent backward or held straight it was safe to assume that anterior flexion sometimes occurred, even though one had never observed it. After defining the various forms of tetanus, Celsus contents himself with giving rather elaborate directions as to the treatment of the malady. He wisely cautions that cold is to be guarded against, that there should be a fire burning constantly in the room in which the patient is lying, especially during the hours before dawn when the cold is particularly intense. Judicious bloodletting, warm and moist fomentations and emollients composed of heating substances are to be applied. If the pain increased resort was to be had to cupping from the neck or to the cautery. "When the pain has been relieved and the neck begins to be moved it can be

[22] Clifford Allbutt, *Greek Medicine in Rome*, p. 205.

recognized that the disease is yielding to treatment." It is strange that Celsus made no mention of spasm of the jaw muscles, which is easily the most outstanding manifestation of tetanus, but regarded the disease as an affection of the neck; perhaps he confounded tetanus with certain forms of meningitis which are characterized by cervical rigidity but which never exhibit characteristic spasm of the jaw muscles.

Resuming our perusal of the works of the Graeco-Roman period, including those of Pliny the elder (23 to 79 A. D.), Rufus of Ephesus (98 to 117 A. D.), Galen (131 to 201 A. D.) and Aretaeus the Cappadocian, we learn little of importance about tetanus. Recommended for the treatment of lockjaw in various portions of Pliny's indiscriminate catalogue of facts and superstitions, *Natural History*, are hellebore, nitre, castorium [23] and the coagulum found in a calf's stomach. Rufus of Ephesus also cites the therapeutic value of castorium given by mouth or applied externally. Galen and Aretaeus appear to have been contemporaries but neither quotes the other's writings, a circumstance that Adams attributes to professional rivalry, which was "even a stronger passion in ancient than in modern times." Aretaeus, who probably lived in the second century A. D., devoted a good deal of attention to tetanus—its etiology, symptomatology and treatment. His classification is essentially the same as that of Celsus, comprising the three varieties, tetanos, opisthotonos and emprosthotonos. However, unlike Celsus, he stressed the importance of the jaw symptoms, saying that all of the varieties of tetanus were "affections of the muscles and tendons about the jaw; but the illness is communicated to the whole frame, for all parts are affected sympathetically with the primary organs"—a rough approximation to the truth, to be sure, but correctly focusing the attention on a most characteristic symptom. The various positions assumed by the body are stated to be determined by the relative tensions exerted by the anterior and posterior tendons.[24]

[23] The dried secretion of the preputial glands of the beaver, a powerful antispasmodic.

[24] Aretaeus apparently employs both τόνος and νεύρον as signifying tendon, but states that the latter term also indicates tension: "τόνος γὰρ νεύρον καὶ ἐντάσιος ὄνομα." Allbutt (p. 148) has pointed out that the great Alexandrian anatomists Herophilus and Erasistratus distinguished clearly between nerves, tendons and

"The causes of these complaints," writes Aretaeus, "are many; for some are apt to supervene on the wound of a membrane, or of muscles, or of punctured nerves, when, for the most part, the patients die; for the 'spasm from the wound is fatal.'"[25] We know that he is speaking of tetanus and not meningitis when he refers to the difficulty of separating the jaws, even with levers or a wedge, in order to administer nourishment. Also characteristic is the resulting spasm of the muscles of deglutition: "But if one by forcibly separating the teeth, pour in some liquid, the patients do not drink it but squirt it out, or retain it in the mouth, or it regurgitates by the nostrils; for the isthmus faucium is strongly compressed." In the same paragraph occurs the first mention of a rattling noise made by the teeth, ὀδόντων ἄραβος, a manifestation that has since rarely been mentioned.[26]

Although celebrated for his vivid and detailed portrayals of diseases, Aretaeus is not always quite accurate. Haeser,[27] for example, detects a note of meningitis in his account of tetanus, probably because of the statement, "the jaw sometimes gapes." Of course, in tetanus the jaw never drops unless the patient is profoundly narcotized or *in extremis*; Hippocrates looked upon relaxation of the jaw muscles as an indication of approaching death. Aretaeus concludes his semeiotic discussion on a gloomy note: "An inhuman calamity! an unseemly sight! a spectacle painful even to the beholder! an incurable malady! owing to the distortion, not to be

ligaments. It seems unlikely that Aretaeus, who lived many years later, should have been ignorant of this distinction; and on this account I feel that Adams possibly does Aretaeus a slight injustice in translating the word νεῦρον as nerve.

[25] Cf. Hippocrates.

[26] The word trismus, which now signifies a tonic spasm of the muscles of mastication, probably indicated some other symptom originally, for it is derived from the word τρίζειν or τρύζειν, to gnash or grind the teeth. Mücke, who regards "Knirschen" as an exact translation of this word, states that in ancient times the word referred usually to the sound produced by grinding the teeth together, although passages may be found, as in the works of Caelius Aurelianus, where the word is employed to designate another kind of noise. Mücke describes an instance of *trismus clonicus* in which the teeth were ground together with such force that it seemed as though they might break under the strain.

However, gnashing of the teeth probably occurs more frequently in domestic animals afflicted with tetanus, especially in sheep, where the sound can often be heard at a considerable distance.

[27] Quoted by Allbutt, *Greek Medicine in Rome*, p. 283.

recognized by the dearest friends; and hence the prayer of the spectators, which formerly would have been reckoned not pious, now becomes good, that the patient may depart from life, as being a deliverance from the pains and unseemly evils attendant on it. But neither can the physician, though present and looking on, furnish any assistance, as regards life, relief from pain or from deformity. For if he should wish to straighten the limbs, he can only do so by cutting and breaking those of a living man. With them, then, who are overpowered by the disease, he can merely sympathize. This is the great misfortune of the physician."

In view of this counsel of despair, it is surprising to find in the treatise on the therapeutics of acute diseases most elaborate directions for the management of tetanus, including venesection, a bland nourishing diet, stimulating frictions, warm fomentations and cataplasms. These are remedies to be employed in tetanus that cannot be traced to a wound. " But if the spasm be connected with a wound, it is dangerous and little is to be hoped. We must try to remedy it, however, for some persons have been saved even in such cases." This is excellent advice, quite worthy of being followed today, for there are some physicians who regard tetanus as so hopeless a condition that they hesitate to resort to vigorous treatment. Aretaeus considers the importance of local treatment of the wound, the application of such medicines " as excite gentle heat and will create much pus; for in tetanus the sores are dry. Let the application consist of the manna of frankincense, and of the hair of poley, and of the resins of turpentine and pine-trees, and of the root of marsh-mallow and of rue, and of the herb fleabane. These things are to be mixed up with the cataplasms, melting some of them, sprinkling the others upon them, and levigating others beforehand with oil; but the mallow, having been pounded, is to be boiled beforehand in honeyed-water. We are to sprinkle, also, some castor on the ulcer, for no little warmth is thereby communicated to the whole body, because the rigors proceeding from the sores are of a bad kind."

The renowned Galen, fitting tetanus into his humoral doctrines, expressed the view that tetanus was caused either by repletion or inanition and that the variety due to inanition, or dryness of the nervous structures was incurable, " *sed que ex nervosarum partium*

siccitate provenit, insanabilis est." [28] A patient having tetanus due to repletion was to be freed from an overabundance of phlegm by purgation, vomiting and abstracting of blood. Galen distinguishes with remarkable precision between tetanus and epilepsy; "The sacred disease" (epilepsy), he wrote, "is a convulsion of all parts of the body, not continuous as is the case in emprosthotonos, opisthotonos and tetanos (that is, rigor of nerves), but occurring at intervals. Not only in this respect does epilepsy differ from the other varities of convulsion but also in the appearance of unconsciousness or insensibility, wherefore it would seem that this affection has its seat in the higher regions of the body, that is in the brain." [29]

Aëtius practically repeated what Galen had written, stating that tetanus was caused by repletion or aridity (*siccitas*), that the form caused by the latter no one could cure. A potion made of the juice of centaureum and of seseli mixed with vinegar was recommended; castorium could be used both internally and externally.

IV. The Byzantine Writers

Practically all of the Byzantine encyclopedists included tetanus in their works. The mightiest of them, Oribasius, is said to have compiled a gigantic work, comprising seventy volumes, but this has been partly lost and only the synopsis which Oribasius wrote for the instruction of his son has been preserved in full. In this compendium there appears a brief chapter on tetanus, limited to the treatment of this malady. It is recommended that the patient be phlebotomized and wrapped in wool soaked in sicyonian and beaver oils. Cupping is regarded as beneficial when applied over the neck, the hypochrondrium, bladder and kidneys, but the physician is advised to avoid removing too much blood at one time. The oil bath is to be resorted to in case these measures fail to bring about improvement, but the patient is not to remain long in the bath of oil because of its debilitating effect. The following prescriptions are given:

[28] *Methodus Medendi*, p. 195.
[29] *De Locorum Affectorum Notitia*, p. 146.

A liniment. Of nard (valerian), one sextarius; of wax, oz.ij; of malabathrum, of amomum, of storax, and of mastich, of each oz.j; of castor, of adarce, of euphorbium, of pepper, of each oz.j; of spikenard, of opobalsam, of each oz.j.

A potion for opisthotonos. Of the root of panacea, of white pepper, of costus, of myrrh, of poppy juice, equal parts. Give to the size of the vetch called *aracus* at bedtime. It is also a remedy for orthopnoea. Let the diet be attenuant, of easy diffusion, and by all means not excrementitious.

Paul of Aegina, "the last of the Greek eclectics and compilers" (Garrison), in a fairly complete discussion of the forms of tetanus, states that Pelops thought that the cause of tetanus was "a flatus, the thick and nebulous air filling the muscles," [20] and that the air being cold and congealed served to produce difficulty in motion. Pelops, like Hippocrates, believed that the most potent remedy for all the varieties of tetanus was the development of fever when there was none in the beginning.

Paul, continuing to enumerate the causes of tetanus, states that the ailment is occasioned sometimes, although rarely, by fatigue, by lying on the ground, lifting weights and falling, a wound, a burn, a blow or "any other thing which can bring on such an injury to the nerves." He observes in describing the symptoms that "sometimes a sardonic laugh comes on." [21]

It is interesting that the course of treatment recommended by Paul of Aegina is identical with that set down by Oribasius, which probably signifies that the compilers derived their opinions on this subject from the same author.

Before going on to the Arabic period we should consider briefly the contributions made to the study of tetanus by veterinary physicians, who observed the disease in horses and other domestic animals. According to Gustav Graumann, who has given a splendid account of this aspect of the history of tetanus, the first reference

[20] Cf. the Chinese belief.

[21] Καὶ πότε καὶ γέλως αὐτοῖς σαρδόνιος ἐπιγίνεται. Σαρδόνιος is possibly derived from Σαρδόνιον, a plant of Sardinia (Σαρδώ), which is said to screw up the face of the eater. More likely, however, the word is derived from σαίρω, "to draw back the lips showing the teeth, to grin like a dog." Caelius Aurelianus, fifth century A. D., seems to have been the first to describe the facial expression characteristic of tetanus, "Sine ratione veluti ridens vultus." (*De Morb. Acut. et Chron.*, Book III, 6.)

to equine tetanus is found in the works of Aristotle (384-322 B. C.), who characterized it as a disease in which all the veins of the head and the neck were contracted, causing the animal to walk with stiff legs. But it is to Absyrtus of Prusa (290-350 A. D.), veterinary surgeon in the army of Constantine the Great, that credit must be given for the first exhaustive account of tetanus in horses. The description left by Absyrtus is so detailed and vivid that one feels certain that had he devoted his efforts to the diagnosis and treatment of human ills he would have provided his contemporaries with an account of human tetanus superior to any that had been written. However this may be, the fact remains that a clearer and more accurate picture of equine tetanus than that of Absyrtus has not been written:

> The disease opisthotonos is manifested as follows: The head and neck of the horse are extended; the ears are erect so that they cannot be bent; the eyes are sunken . . . the lips are pressed together, and the mouth can in no wise be opened; the tongue is so swollen that the animal can neither eat nor drink; the tail is extended or stands off from the body; and the spine is so stiffened that it cannot be bent to either side. When the horse walks it cannot progress with its hind legs but drags the extended feet. The front legs cannot be flexed. . . . The horse can only progress with the greatest difficulty. When it tries to rise it falls down. Usually, owing to stiffening of the nerves of the back, the bladder is so affected that the urine is excreted only with difficulty. When the animal is lifted up it cannot stand on its hind legs but stands on its forelegs like a dog. The name opisthotonos indicates that the forepart of the animal is brought nearer the back.

Among the causes of tetanus given by Absyrtus are: Treading on a nail, marching in the cold of winter after having perspired, lying on stony ground, a wound in the inguinal region.

A contemporary of Absyrtus, the horse doctor (ἱππίατρος) Hippocrates,[32] distinguishes three types of tetanus in horses which may simply be taken to indicate three degrees of the disease: mild, moderately severe and very severe. Hierocles, Theophrastus, Pelagonius and Vegetius Renatus gave descriptions of equine tetanus that appear to be based upon the account of Absyrtus.

[32] Not to be confused with the Father of Medicine. Hippocrates seems to have been a fairly common name. In Pauly-Wissowa's *Encyclopedia*, one finds biographical notes on at least ten writers bearing this name.

V. The Arabian Writers

Arabian writers in general were content to adopt the teachings of their Greek predecessors in respect to tetanus, and one finds in their works no new therapeutic measures. Albucasis (Alsaharavius), like his countrymen, was partial to the use of the cautery and advised using it in cases of *tortura oris* and *spasmus cynicus*[88] that were occasioned by a superabundance of phlegm, but cautioned against employing this kind of treatment in varieties of spasm that resulted from dryness or "following spasm of a tendon or nerve," which called for more conservative measures, such as antidotes of various kinds, mercurials and sternutatories; if these failed to bring about improvement a cautery was to be applied to three places: at the base of the ear, a little below the temple and at the junction of the lips. Elsewhere (*Pract.* I, 2, xx) he states that *tortura faciei* may arise from the blocking of nerves with thick phlegm or as the result of spasm of the nerves supplying sensation and motion to the part. The cure is accomplished by evacuating the phlegm, that is, by inducing perspiration, administering gargles of synapus and pepper and applying ointments to the junction of the neck and face. The author proceeds to ascribe a variety of additional meanings to the term *spasmus*, which carries him entirely outside of the sphere of tetanus, for example, *tortura oculi*, spasm of the *meatus spermaticus*, and so on.

Serapion recommends that the patient be wrapped in woollen garments and made to drink cyrenian oil. The part affected by spasm is to be anointed with oil of lilies. The patient is to sit in a wine vessel containing warm water in which anise and honey have been boiled together with other substances. Rapidly digested food is to be administered. Avicenna, Mesue, Rhases and Haly Abbas recommended similar lines of treatment.

VI. Mediaeval Period

In the many learned discussions on tetanus that appeared between the time of Hippocrates and the middle ages we look in vain for case

[88] *Spasmus cynicus* is a confusing term which means literally spasm of the features resembling the grinning of a dog. It is not always clear whether this spasm is uni- or bilateral. Generally speaking, however, it indicates a unilateral twisting of the mouth exposing the teeth on that side, and as such may be associated with hemiplegia, Bell's palsy or cephalic tetanus.

reports. Indeed, it is not until shortly before the Renaissance that we find one. In the *Chirurgia Magna* of Lanfranchi (1296), an Italian surgeon who fled to France at the time of the squabble between the Guelphs and Ghibbelines (Garrison), there is a chapter devoted to tetanus. This work, written in Latin, enjoyed a great vogue and was translated into English by an anonymous contemporary of Chaucer (Ashmole MS., 1396). I should like to cite, from a recent edition of the manuscript, an entire chapter that treats of tetanus, but am deterred from doing so because the translator has not adhered sufficiently closely to the Latin of Lanfranchi. I cannot, however, refrain from quoting several passages from this delightful old English text. Wherever necessary I shall give my own bald literal translation of the Latin.

The chapter dealing with tetanus is introduced in a logical manner: " Nessessarie þing is to a surgian to know þe causis of a crampe, þe which þat comeþ to a wounde þat schulde be heelid, and also þat he knowe þe disposicion of him þat haþ þe crampe, & also what þing þat þe crampe, is, þat he mowe resonabliche hele þe crampe." The causes of the " crampe þat comeþ to a wounde " are pain, cold and putrefaction. The surgeon is instructed to take steps to insure that these conditions are eliminated; thus Lanfranchi appears to be the first to stress prophylaxis in tetanus, " for," he writes, " it is more sikir to defende þat a crampe ne come not, þanne aftir þat he is come with medicyns þat is douteful to do away "—excellent advice that applies today. In wounds of nerves and tendons pain is to be assuaged with oil of roses and cramp prevented by blood letting, cupping and the use of clysters. If these measures are not successful, then it is necessary to sever the damaged nerves and tendons, " þouȝ þat þe felynge or þe meuynge of þe lyme to whom þilke senewe or þilke corde serueþ in parti or in al be lost. For it is bettere þat a man lese þe felynge & þe meuynge of a lyme, þan for to deie." " But," adds the author, " it is bettere, if þat þou cowdist, to kepe a man þer-fro with oþere medicyns þan þat þe senewe or þe corde be kutt al atwo." As an illustration of the handling of outspoken tetanus the following case history is given:

A certain scholar of mine by the name of Oliver cured a sheather [84] of a wound of the head; the panniculus covering the bone had been injured and not the cranium itself. The physician cleaned up the wound and then sewed it together. The wound having been sutured the damaged tissues gave rise to a spasm in the wounded area. When I was called to see the sick youth I found that he had the cramp; there were besides many pustules about the face, which is a bad sign in wounds of the head. I felt that the patient would die; nevertheless, wishing to do everything within reason, I caused the head to be shaved, and with a razor I reopened to its depths the wound, which was consolidated; [85] and I filled the entire wound with warm oil of roses, anointed the head with the same oil of roses mixed with a little vinegar. With the oil alone I anointed the neck and I put on the wound the yolk of an egg together with oil of roses, and I bound the head with a bandage over coarse flax. Opening the mouth, I placed therein chicken broth and clear wine mixed with much water. When I returned on the morrow I found the young man of better disposition, for he opened his mouth and spoke more clearly. Nevertheless, I found the wound dry, so I repeated the medicine and inunctions. On the third day the skin of the head became moist, whereas before it had been dry as though exposed to the fire and so attenuated that there appeared to be no flesh between the skin and the cranium. The cure continuing thus, the wound at length suppurated and the youth was cured of spasms. He had also an excellent cure of the wound; but this was a cramp without fever.

The author states that he does not recollect having seen fever preceding spasms in wounds of the sinews or head without the patients having died in spite of the use of various remedies. Lanfranchi has the temerity to deny the general applicability of the Hippocratic aphorism, " A fever supervening on a spasm cures the patient "; he does not approve of the use of warm ointments in patients that have tetanus resulting from a wound, " þouȝ þat þilke oynement myȝte be profitable in a crampe wiþoute wounde, & where þat humouris abounde, namely, if it is fleume." [86]

In classifying the varieties of tetanus Lanfranchi follows Paul of Aegina and Aretaeus, concluding his discussion on a despairing note reminiscent of the latter author: After enumerating the signs of severe tetanus, in which " al þe bodi is stif & streyned, as a staf were

[84] Vaginarium, a sheath maker. A sheath is a part of a plow of the older type—the bar connecting the beam and sole in front. (O. E. D.)

[85] While this procedure was not a true debridement, it at least permitted free drainage.

[86] Phlegm.

putt yn at his necke & out at his ers," [87] he says that when these manifestations occur in association with wounds of the head or of the sinews, " þei techen bettere þe leche to fle from þe sike man þan on him to abide and cure."

Guy de Chauliac, Lanfranchi's successor and the father of French surgery, quotes Galen on the causes and varieties of spasm, employing his well known simile to illustrate how inanition and repletion can bring about tetanus. These forces may be thought of as operating on nerves and tendons as heat and moisture affect the strings of a musical instrument—the taut strings eventually break when the instruments are kept in a dry or humid place; therefore musicians loosen the strings before they put their instruments away. In addition to the types produced by inanition and repletion there is a third variety of tetanus caused by pain, puncture of nerves and tendons and various poisons. Our author very wisely refrains from considering the various forms of spasm and their causes in great detail, for this would only be speculation; it suffices for a surgeon to know what he has already written on this point. De Chauliac states that universal spasms result when the noxious influence reaches the brain, where attempts to expel it lead to drawing up of the nerves and nervous parts and cause them to be convulsed. Spasms are said to be " particular " when the harmful agent does not get to the brain but remains confined to a member, causing it to be curved. The Arabic writer Avenzoar is given credit for this statement, which might lead some to believe that he was acquainted with local tetanus. However, in the absence of an actual example of this form of tetanus such an inference is not justified. De Chauliac well summarizes the main features of general tetanus, including the characteristic risus: " motus membrorum difficultas, colli tensio, labiorum contractio, ac si vellet ridere, maxilarum, et dentium, et gutturus strictura, oculorum et totius faciali tortura." Under the head of treatment there is included—in addition to the usual procedures of phlebotomy, inunction, the use of gargles, sternutatories and clysters—the precaution of inserting a stick between the teeth so that the mouth may not close entirely. Finally, it is recommended that complete section of the nerves or sinews be resorted to when other measures fail, " for

[87] A vivid but not quite accurate translation of " sed totus stat rigidus et distensus a summo capitis ad inferius per corpus infixus."

it is better to lose the function of a single member than the use of all members." [88]

VII. The Renaissance

The outstanding figure in the history of tetanus during the Renaissance is the incomparable Ambroise Paré. After practically repeating what Guy de Chauliac had written concerning the various causes and signs of tetanus, Paré sets forth a formidable system of treatment an original feature of which is the employment of an ingeniously devised instrument to force the mouth open, as much or as little as one wishes, " vn instrument qui se dilate et ouure par le benefice d'vne vis, tant et si peu qu'on veut." But Paré does not disappoint us in our quest for case histories of tetanus, for in Volume II of his collected works is found an instance of post-operative tetanus which followed the first exarticulation of the elbow joint in the annals of surgery. The patient was a soldier who had suffered an arquebus wound of the left forearm near the wrist. The ball, besides lacerating the tendons and nerves, had fractured several bones. Gangrene set in, inflammation extending as far as the thorax, and the patient's condition became so grave that he was abandoned by several surgeons. Paré, having been summoned by friends of the stricken man, had the hardihood to amputate at the elbow. There was a great deal of bleeding which was arrested by means of the actual cautery, no other method being available at the time. Multiple incisions were made into the remaining gangrenous areas and a cautery was applied both to arrest bleeding and to consume any purulent matter that might have been present. Sundry local applications were made. Fifteen days later tetanus set in, which Paré states he might have prognosticated, for the patient, who had been placed in a granery and covered scantily, was exposed to the cold and wind. " Seeing him affected with spasm and retraction of the extremities, lips and face twisted and drawn as if he wished to smile (ris Sardonic), which are manifest signs of convulsion,

[88] Guy de Chauliac attributes this advice to Rhases (" ut consulebat Ras."), but I have been unable to find such a passage in the works of Rhases. It is possible that the sentence was taken from Lanfranchi's treatise which Guy de Chauliac cites more than a hundred times (Nicaise).

I was moved to pity. Desiring to carry out the duties of my art and not being able to do anything else at the time, I had him put in a stable in which there were many animals and a large quantity of dung. Then I had fires made in two stoves, while nearby I rubbed his neck, arms and legs with liniments . . . avoiding the pectoral regions." The patient was then covered with manure (similia similibus curantur!) [89] and enveloped in a warm blanket. He remained thus for three days and three nights without getting up, during which time a small flux of the stomach and a great sweat arose. He began to open his mouth a little, which led Paré to begin using his instrument. Having opened the soldier's mouth he inserted a willow stick, withdrew the clamp and gave the patient milk and eggs. By these means a cure was effected.

Instead of counselling the physician to abandon his patient when the situation appears hopeless, Paré advises him not to despair but to do all in his power, leaving the rest to the *vis medicatrix Naturae*; " Parquoy faut que le Chirurgien ait tousiours deuant les yeux, que Dieu et Nature luy commandent ne laisser les patiens sans faire tousiours son deuoir, combien qu'il preuoye tous signes mortels. Car Nature fait souuent ce qu'il semble au Chirurgien estre impossible." The chapter ends with a magnificent credo that must ever guide the physician in his care of the sick: " i'ay bien voulu traiter telles cures desesperées et laissées à fin de tousiours stimuler et donner courage aux ieunnes Chirurgiens qui commencent à exercer l'art, de non laisser les griefs blessés, encore qu'ils ayent signes mortels, mais s'efforcer à faire ce que l'art commande: les priant n'y besongner par acquit, ni aussi les laisser per defaut de payement s'ils sont indigens, mais plustost leur aider par vne charité, laquelle nous sommes tous tenus par le commandement de Dieu exercer l'vn enuers l'autre. Et là où on auroit fait quelque cure digne de louange, ne se la faut attributer, mais à Dieu: considerant et connoissant que toutes bonnes choses procedent de luy, comme d'vne fontaine qui ne se peut espuiser, et rien de nous comme de nous."

One searches in vain through the writings of Paré's contemporaries for an unmistakable example of tetanus, the accounts that

[89] This truly homeopathic treatment was employed by Absyrtus of Prusa in equine tetanus.

turn up being invariably vague and lacking in detail. The few case histories reported during the seventeenth century are disappointingly brief. For example, Dominicus Panarolus, after devoting half of his *Observatio* to a lament concerning war (which, by the way, reminds us that the world is very much the same as it was in his day, with its continual wars and threats of war)—" crudelitas apud homines plus quam in aliis animalibus regnat, ideo quotidie tuba canit classicum; quotidie sonitus Caelum resonat, undique ad arma audimus "—relates the sad history of a certain young man who, having been wounded in the ankle with a sword thrust, succumbed miserably to opisthotonos. Panarolus states that fatal convulsions frequently arise from wounds of the foot, for beneath the Achilles tendon lies a nerve of great size which ramifies over the whole extremity, rendering it quite sensitive to various influences. Indirectly the result of warfare, is another sad case of a youth who wounded himself in the tarsus and metatarsus while carelessly discharging an arbalest; opisthotonos supervening, he died.

Certain of the case reports are susceptible of various interpretations. Bartholin's *Tetanus ab esu anguillae* (tetanus from the ingestion of eel) undoubtedly was not tetanus at all but food poisoning, hysteria, or some other affliction, for the victims lost consciousness so that they could not perceive a needle prick. Their bodies became rigid and curved anteriorly as in opisthotonos, in which state they remained for three days.

IX. Eighteenth Century

During the eighteenth century several factors conspired to produce a rapid growth in the literature of tetanus. The disease was observed with great frequency by French, Dutch and British colonial physicians stationed in the Americas and the East and West Indies. Many of their reports were published in medical periodicals, which had but recently been introduced. Military surgeons had abundant opportunities to study the disease on the battle-fields. The majority of the reports seem to be concerned with establishing the value of this or that new remedy for the disease. A Dutch physician, Jacob Bontius, who practiced in Java, was the first of a long series of colonial physicians to report observations on tetanus in tropical and semitropical

climates. In his work on diseases peculiar to the East Indies, *Medicina Indorum* (1717), there is a section on lockjaw. "Particular" and general varieties of the malady are recognized, the former being mild and non-fatal. Bontius regarded tetanus as the result of the action of a poison, and quite reasonably directed his therapy toward eliminating the noxious substance from the body. Copious bleedings, frictions and inunctions are recommended; cupping *sine scarificatione*, applied to the neck, lumbar region, arms and breast, all these measures being aimed at decreasing serous and bilious humors. If following the application of these remedies the patient begins to recover his ability to swallow, antidotes are to be given which serve to dispel the poisonous matter in the sweat and urine, such as lapis bezoar, shavings of rhinoceros horn mixed with theriac and mithradatum. Bontius' example of tetanus is disappointing, for it is not at all unlikely but that the patient had instead a form of meningitis: "A certain inebriated soldier slept throughout the night on the ground. No sooner had he wakened than he was seized with spasm which caused his body to be curved backwards; and he remained quite stiff. He was taken to the hospital, where it was discovered that he could not swallow; he spoke indistinctly as though from a subterranean space and glared at us fiercely. In spite of intensive treatment the patient died on the fourth day after having suffered the cruelest tortures." The *αὐτοψια* revealed a fetid viscid material in the ventricles of the brain, which of course points to a diagnosis of pyogenic meningitis rather than lockjaw.

A large group of French physicians published observations on tetanus which they saw with comparative frequency in natives of the South American colonies. Bajon, surgeon to the Royal Hospital in Cayenne, named two varieties of tetanus, *mal de mâchoire*, a disease of the newborn, and *catarres*, the corresponding disease in adults. He believed that exposure of infants to sea breezes had much to do with bringing on the malady, and relates how an inhabitant of this region caused a great forest along the sea coast to be cut down—a rash act which led to the death from tetanus of nearly all the infants that stayed in his house. The natives soon learned to protect their infants from drafts, he says, and refrained from taking them to church for baptism until they were nine days old, when the danger

of contracting lockjaw no longer existed. Fortunately, it was also recognized that proper treatment of the umbilical cord is of first importance in the prevention of tetanus.

Heurteloup, who practiced in the Antilles, tells how the negroes, who were in the habit of going about in their bare feet, often came down with tetanus as a result of treading on nails, thorns and splinters of wood. Experience having taught them the serious import of such injuries, they were quick to extract foreign bodies from their feet and to promote free bleeding from the wound. Finally, the extremity was washed. This remarkable prophylaxis observed by the blacks was fortunately adopted by some of their white masters. Less effective, however, were prophylactic methods employed by natives of other warm countries, as for example, the application to a penetrating wound of scarabs crushed in warm oil (Dazille), egg yolks and turpentine. According to Desportes, the negroes relied upon cataplasms, embrocations and frictions for the cure of tetanus, while the more drastic methods of the Spanish colonists involved copious bleeding from all four extremities and the repeated induction of vomiting. Despite their wide experience with lockjaw the colonial physicians left no accounts of local tetanus. Indeed, the only convincing example of this aspect of the disease seems to be one which was communicated by Valsalva to Morgagni and recorded by the latter in his treatise, *De Sedibus et Causis Morborum*. "A young man, about twenty-six years of age, had first a slight swelling of the fauces; and his appetite pall'd. To these complaints, after some days, a convulsion of the left arm was added, so that it was entirely immoveable and inflexible; and soon after, the same thing happen'd to the whole body, of a sudden, which had happen'd to the arm; so that the patient now was not able to move himself to any side, but continued stretch'd out in a straight posture, as he was taken, his body being immovable and rigid, except that, a little while after, he was able, in some measure, to move his hands and his feet only. He was brought into the Hospital of St. Mary de Vita, at Bologna, where the fever and convulsion, with which he had been seized were found to be that disorder which the Greeks call τέτανος. From the first day, in which he was seized with it in his whole body, even to the very day of his death, he had profuse sweatings. But, on

the beginning of the fifth day, death was the consequence of a new contraction, which bent his body entirely to one side." Had there been reference to a wound in the stiffened arm we could have made our diagnosis of local tetanus with greater assurance.

Many celebrated physicians of the eighteenth century pondered the cause and cure of tetanus. John Hunter, who noted the disease both in human beings and in animals—" I had a stag which died from locked jaw from a compound fracture of the leg," he tells us,—had original ideas as to its etiology, believing that irritation was an important cause. On one occasion he himself almost acquired tetanus " at a time when weak." " I threw a stone at a deer," he relates, " and over-exercised the muscles of the arm which produced cramp and extravasation in my arm, and loss of use of the muscles; this produced sickness and paleness, and after a little time cramp came on in my leg; but at last this and the other symptoms went gradually off; if the irritation had continued a locked jaw might have come on." Hunter says nothing about a twinge of conscience which he ought to have had.

He placed due emphasis upon wounds as a predisponent or immediate cause. " A man had a locked jaw about a fortnight after a nail entered the sole of his foot, which he did not at the time regard as of any consequence, the wound not being larger than that from bleeding, and not attended with any pain, inflammation or hardness. He died and after death I found a black line continued to a hard body under the skin, which could be dissected out almost like a lymphatic gland, and was found to be a bit of leather, surrounded by coagulable lymph; the black line was the mark of the nail. Here was no pain which could be the cause, and little, if any, inflammation, and the suppuration had not begun; hence it appears that the spasm arose of the slight irritation." He could understand how inflammation might be the predisponent cause in large suppurating wounds, but cases like the one cited puzzled him, for inflammation was lacking.

The treatment of tetanus was in a most confused state in Hunter's day, the cures employed being too numerous to mention. The use of cold applications enjoyed a great vogue and he was one of its staunchest advocates, recommending that a mixture of snow and salt be applied to the stiffened part and that the patient be put into an

icehouse or sent to a cold climate as soon as possible. He often stated in his lectures that if he were stricken with tetanus he would fly to Nova Zembla or throw himself into an ice-house.

While in England Hunter advocated freezing tetanus out of people, in America Benjamin Rush warmed his patients with wine, which he said should be given in quarts even in gallons. However, Rush forbade the use of ardent spirits, remarking scornfully, "A quack has lately cured tetanus by giving ardent spirits in such large quantities as to produce intoxication. Upon being asked the reason for this strange practice he said he had always observed the jaw to fall in drunken men and anything that would produce that effect he supposed to be the proper cure for lockjaw."

With these quaint observations of Hunter and Rush, we conclude this brief historical sketch, leaving, at least for the present, the more recent history of lockjaw in the capable hands of Brunner, Rose and Abel.

It is a pleasure to thank Dr. O. Temkin for the valuable suggestions and the assistance he has given in connection with this paper.

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THE FOUNDATION OF AMERICAN METEOROLOGY BY THE UNITED STATES ARMY MEDICAL DEPARTMENT

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Mark Twain once remarked that while much had been *said* about the weather, very little had ever been *done* about it. While this is of course amusing, it is perhaps not literally true. Something *has* been done about it. It has been studied, and though we may be unable to change the weather, we can at least warn folk as to what they may expect. The development of the science of weather forecasting is but one of the phases of meteorology and climatology for which the Medical Department of the United States Army must be given its due. It is surely one of the greatest of scientific accomplishments, though of late years often overshadowed by stress laid on other achievements of our Corps. One must consider the whole development of meteorology in the United States to appreciate what the country owes to the Army Medical Department. It all began with records kept for nigh a century exclusively by medical officers of the Army, and finally the Weather Bureau itself was established by an Army medical officer.

First Official Meteorological Observations in America

The first official meteorological records in America began with the order of Dr. James Tilton, 1745-1822, Physician and Surgeon General of the Army, who on 2 April 1814 directed hospital surgeons to record the weather. Tilton was a wise man, and this foresight on his part was the basis of American meteorology. Tilton was a veteran of the Revolution, having served successively as Surgeon of the Delaware Regiment (1776), Hospital Physician (1777) and Hospital Physician and Surgeon (1780) and in this last capacity to the end of the war. He devised and established a hospital group of small

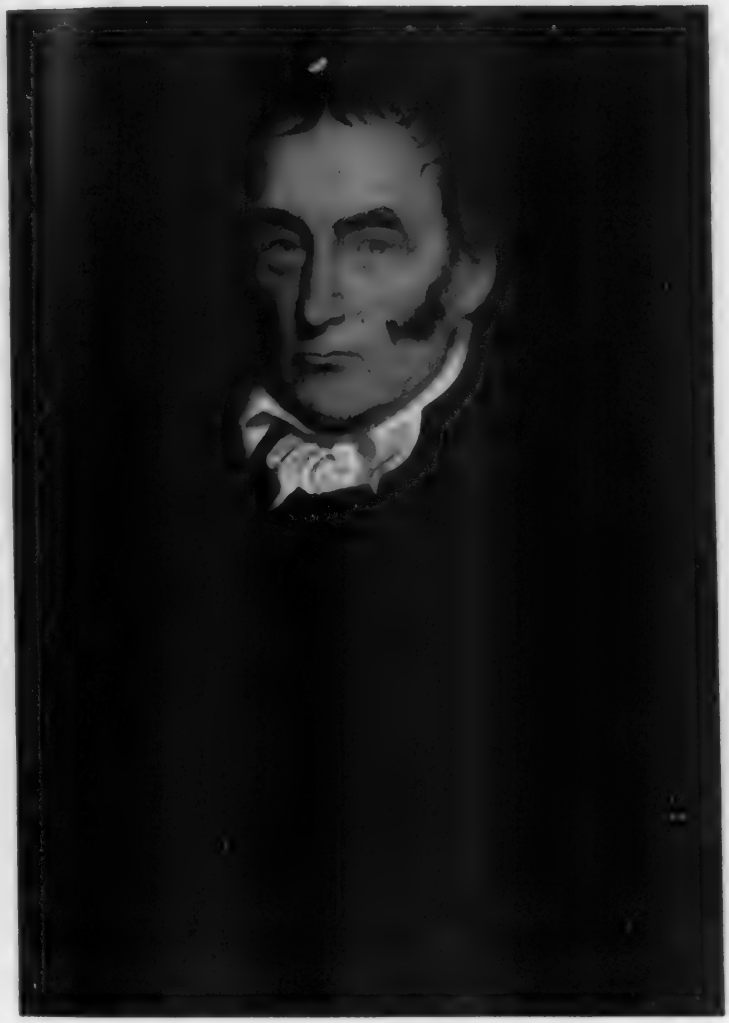

Fig. 1.

Dr. JAMES TILTON (1745-1822) of Delaware.

Physician and Surgeon General, United States Army, 1813-1818. On 2 April 1814 he ordered hospital surgeons to record the weather. This was the first official meteorological record in America. (Portrait in the Army Medical Library).

well-ventilated log huts, each to accommodate but six patients, and a great decrease in hospital mortality followed the innovation. Too bad that his lesson was forgotten in later wars, including the World War, when overcrowding played an all too important part in the causation of disease. Tilton's paper on jail (typhus) fever was a classic in its day. He became the first president of the Delaware Society of the Cincinnati, and from 1785 sat in the Continental Congress. He was later a member of the Delaware House of Representatives for several terms. In 1813 he was appointed Physician and Surgeon General of the United States Army, and held that office through the War of 1812.

Though it is Tilton to whom we must give credit for ordering the recording of meteorological data by his medical officers, the War of 1812 was in progress and Tilton himself was in the field with the Army in the north. Efficient compliance was impracticable. Therefore it remained for his successor to carry out the idea. Tilton is often forgotten in praise of those who followed him in office, who continued the requirements he had already laid down.

Early Unofficial Records

Even before the official weather observations initiated by Surgeon General Tilton, there had been kept several series of records by private individuals. The first of these were recorded during 1644-1645 by the Rev. John Campanus at the Swedes' Fort near Wilmington, Delaware. But Campanus soon returned to Sweden and for the next eighty-four years there were no recordings, as far as now known. The Hon. Paul Dudley, Chief Justice of Massachusetts, kept a series of records at Boston for 1729-1730. A little later Dr. John Lining at Charleston, South Carolina, kept a detailed registry of four weather elements, namely, temperature, pressure, humidity, and precipitation. Lining's records are for 1738-1750. In 1739 Benjamin Franklin kept systematic notes of the weather and the temperature of the ocean, during his return voyage from England. Both Lining and Franklin used the Fahrenheit thermometer. Regular meteorological records were kept by Prof. John Winthrop of Harvard College from 1742 to 1778. In 1753 Franklin reached the important

conclusion that a certain storm in September of that year had traveled eastward across the country. He based the conclusion on the reports from many postmasters, for Dr. Franklin was Postmaster General of the Colonies, and from the fact that an eclipse of the moon was invisible in Philadelphia, where this storm was present, but visible in Boston and was over before the storm began there. This was the first determination, at least in America, of the direction of the travel of a storm as a whole. Between 1772 and 1777 Thomas Jefferson at his home, Monticello, Virginia, and James Madison at Williamsburg, simultaneously made observations of temperature, pressure, wind direction, and other weather elements. These were the first observations in America made in accordance with an agreement that they be simultaneous, a condition which renders them of great value. The history of these early observations is given at length in such works as A. J. Henry, *Early Individual Observers in the United States*, Weather Bureau Bull. 11, 1893, 29-302; A. McAdie, *Simultaneous Meteorological Observations in the United States during the Eighteenth Century*, ibid., 303-304; B. M. Varney, *Early Meteorology at Harvard College*, Monthly Weather Rev., 1908, xxxvi, 140-142, 286-290; C. Abbe, *Chronological Outline of the History of Meteorology in the United States*, Monthly Weather Rev., 1909, xxxvii, 87-89.

The earliest meteorological journal preserved in the Army Medical Library is dated Cambridge, Massachusetts, July 1816. On the first page is written the following lines:

> Among the rules for the medical staff of the Army of the United States is that which makes it the duty of each hospital surgeon and director of a department 'to keep a diary of the weather, together with an account of the medical topography of the country in which he served.' Wherefore the following sketch of Boston and its vicinity, and particularly of Charlestown, is offered to the commander in chief, Major General Brown, by Benjamin Waterhouse, M. D. hospital surgeon and director of Department No. 2, Northern Division, as a first step in fulfilling this desideratum. Cambridge, July, 1816." (*Topographical-medical Remarks, together with Meteorological Tables, or a Diary of the Weather, made near the Headquarters of the 2d Military Department*, by Benj. Waterhouse, Hosp. Surg. and Director, 1816, 4° MS in Army Medical Library.)

This is the same Dr. Waterhouse who introduced vaccination in America.

The unpublished meteorological records of the Army Medical Department extend to 1820 (*Proc. Chicago Meteorl. Congr., 1893*, II, 208).

The Medical Department Continues its Meteorological Work After Army Reorganization of 1818

The United States Army was reorganized on 14 April 1818 under Secretary of War John C. Calhoun, and the meteorological observations by Army medical officers were extended greatly. Indeed Secretary Calhoun is sometimes given credit for pioneer work in this field. The Surgeon General first appointed under the Act of 1818 was Dr. Joseph Lovell 1788-1836, of Massachusetts. He entered the army in 1812 as Surgeon of the 9th Infantry, but through most of the war he was in charge of the general hospital in Burlington, Vermont. His vivid account of his experiences in the War of 1812 may be found in Mann's *Medical Sketches*. He records, among other things, "the crowding of the hospital at Burlington, to such an extent, that the ill effects of crowd poisoning were soon perceived in the increased number of deaths and slow convalescence of many." Lovell held the office of Surgeon General until his death in 1836. "Always devoted and conscientious," says Ashburn, "he was deeply hurt when the Secretary of War, with an eye to economy, recommended the abolition of his office in 1830. Lovell's dignified letter of protest showed clearly that the Secretary did not know whereof he spoke and no more was heard of the matter." (Ashburn, *Hist. Med. Dept. U. S. A., 50*).

Surgeon General Lovell's Instructions

In his instructions, renewing the provisions of Surgeon General Tilton's order that hospital surgeons keep a diary of the weather, Surgeon General Lovell said:

> Every physician who makes a science of his profession, or arrives at eminence in it will keep a journal of this nature, as the influence of weather and climate upon diseases, especially epidemics, is perfectly well known. From the circumstances of the soldier, their effects upon diseases of the army

Fig. 2.

Dr. Joseph Lovell (1788-1836) of Massachusetts.

Surgeon General, United States Army, 1818-1836. Put into effect Surgeon General Tilton's order that hospital surgeons record meteorological data. Was the real father of American Meteorology. (Portrait in the Army Medical Library.)

are peculiarly interesting, as by proper management they may in a great measure be obviated. To this end every surgeon should be furnished with a good thermometer, and, in addition to a diary of the weather, should note everything relative to the topography of his station, the climate, complaints prevalent in the vicinity, etc., that may tend to discover the causes of diseases, to the promotion of health, and the improvement of medical science.

The regulations of the Medical Department, issued in 1818 just after Lovell was appointed Surgeon General, thus state the meteorological duties of a hospital surgeon: "He shall keep a diary of the weather in the form and manner prescribed, noting everything of importance relating to the medical topography of his station, the climate, complaints prevalent in the vicinity. . . ." An assistant surgeon's duties were similarly laid down: "He shall make the proper entries in the book containing the diary of the weather." A regimental surgeon's duties were also given: "He shall observe all the regulations given for the surgeon attending a general hospital in relation . . . the book containing the diary of the weather, the medical topography of his post or station, etc.: and if both the regimental mates be present the senior shall see that the diary of the weather be properly kept." A post surgeon was required: ". . . to observe all the regulations given for a surgeon attending a general hospital in respect to the books to be kept." (*Cf. Regulations for the Medical Department: By order, D. Parker, Adj. & Insp. Gen. September 1818*, pp. 31).

First Meteorological Publications of the Army Medical Department

The first publication on meteorology by the Medical Department of the Army appeared in 1826 under the title: *Meteorological Register for the Years 1822-'25 inclusive, from Observations made by the Surgeons of the Army at the Military Posts of the United States; prepared under the Direction of Joseph Lovell, M. D., Surgeon-General of the U. S. Army, Washington, 1826.* The meteorological tables in this volume served as a contribution to the solution of the question of whether, in a series of years, there is any material change in the climate of a country, and, if so, how far it depends on the cultivation of the soil, density of population, etc. At the time of this

METEOROLOGICAL REGISTER

FOR THE

YEARS 1822, 1823, 1824 & 1825,

FROM

OBSERVATIONS

MADE

BY THE SURGEONS OF THE ARMY,

AT THE

MILITARY POSTS OF THE UNITED STATES.

PREPARED UNDER THE DIRECTION OF

JOSEPH LOVELL, M. D.

SURGEON GENERAL OF THE UNITED STATES' ARMY.

WASHINGTON.

PRINTED BY EDWARD DE KRAFFT.

1826.

Fig. 3.

Title-page of the first Meteorological Report made by the Army Medical Department. Prepared under the direction of Surgeon General Lovell. (Copy in the Army Medical Library.)

publication it was held by some that as the population increased and civilization extended, the climate became warmer. Others held that it became colder; while yet others thought that there was no change. The report gave the observations from eighteen military posts, including Washington. They were situated between N. 21° 57′ and N. 46° 39′ and W. 67° 04′ and W. 95° 43′. The extreme northern station was Fort Snelling, Minnesota, located at the junction of the St. Peters and Mississippi Rivers. Cantonment Clinch, near Pensacola, Florida, was the extreme southern station. The posts having the highest elevation were Council Bluffs, Iowa, believed to be about 800 feet, and Fort Snelling, about 780 feet above sea level. The observations from all posts were arranged in monthly tables with a consolidation for each year, and a similar consolidation for the whole period. The latitude and longitude of each place of observation were given together with the mean temperature at 7 a. m., 2 p. m., and 9 p. m., the aggregate of mean temperature, the highest and lowest degrees and the range, the wind expressed in days of prevalence from each of eight points of the compass, and the weather in days of fairness, cloudiness, rain or snow. It was the intention, if similar observations could be obtained for eight or ten years, to collect such as had been made at an early period of the settlement of the country and to ascertain what changes had taken place in the Atlantic States, either in the mean temperature, the range of the thermometer, the winds or the weather. Of course the problem of change of climate has not been entirely solved to this good day, but this early contribution was an important one, particularly as relating to settlement and cultivation.

Surgeon General Lawson Carries On

Lovell was succeeded as Surgeon General by Dr. Thomas Lawson (1781-1861), of Virginia, a distinguished and colorful medical officer who held the office of Surgeon General for twenty-five years (1836-1861)—longer than any other man. He served in the Army for fifty years and before that was two years in the Navy. "More soldier than physician, he was fiery, strict, jealous of the military rights and privileges of his corps. He labored incessantly to put it

Fig. 4.

Dr. THOMAS LAWSON (1781-1861) of Virginia.

Surgeon General, United States Army, 1836-1861. Directed the meteorological and other work of the Medical Department of the Army for twenty-five years. Three of the first four meteorological reports of the Army Medical Department were made under his supervision. (Portrait in the Army Medical Library. The hat shown in this portrait is in the Army Medical Museum.)

on a basis of equality with other branches of the Army. . . . He stands out as a strong positive figure. He twice had line commands, once a regiment. He had the confidence of General Winfield Scott (whom he accompanied on the invasion of Mexico), and he received the first brevet of brigadier-general ever given to a medical officer." (Ashburn, 66.) He was active in his support of the meteorological work of the Army.

Fourteen years had elapsed since the publication of the Army Medical Department's first contribution to meteorology. The second was published by Surgeon General Lawson. It was: *Meteorological Register for the Years 1826-'30, from Observations made by the Surgeons of the Army and others at the Military Posts of the United States,* prepared under the direction of Thomas Lawson, M. D., Surgeon General, U. S. Army. *To which is appended the Meteorological Register for the Years 1822-'25 (published for the use of the Medical Officers of the Army), Philadelphia, 1840.*

The tables in this record are similar to those of the earlier report, and so permit comparison and consolidation. The compilation and able discussions were the work of Assistant Surgeon Samuel Forry, a Pennsylvanian who had entered the Army in 1836.

For the better presentation of observations, the Country was divided into a northern, a middle and a southern division. In the first, the sea coast of New England, the influence of the ocean was found to modify the range of temperature and the mean temperature of the seasons. In the interior of the State of New York the range increased and the seasons were of violent contrasts. Further west, near the Great Lakes, a climate similar to that of the seaboard was again found; while in the interior, beyond the Great Lakes, extreme ranges of temperature were the rule. It was shown that extremes of heat and cold did not occur at our most southern or northern military posts, as these were situated on large bodies of water which exercised a modifying influence. The Surgeon General expected that a continuance of the required observations would, in the course of time, permit of the composition of a complete meteorological chart. To this end, he procured from Europe a number of Daniell's hygrometers for use at the more important military stations, and De

METEOROLOGICAL REGISTER

FOR THE YEARS

1826, 1827, 1828, 1829, AND 1830;

FROM

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PREPARED UNDER THE DIRECTION OF

THOMAS LAWSON, M.D.,

SURGEON-GENERAL UNITED STATES ARMY.

To which is Appended, the METEOROLOGICAL REGISTER for the Years 1822, 1823, 1824, and 1825: Compiled under the direction of

JOSEPH LOVELL, M.D.,

LATE SURGEON-GENERAL OF THE UNITED STATES ARMY

[PUBLISHED FOR THE USE OF THE MEDICAL OFFICERS OF THE ARMY.]

Philadelphia:

HASWELL, BARRINGTON, AND HASWELL,

293 MARKET STREET.

NEW ORLEANS: JOHN J. HA[illegible]

1840.

ARMY MEDICAL LIBRARY
26183 9
WASHINGTON, D. C., U.S.A.

Fig. 5.

Title-page of the second Meteorological Report made by the Army Medical Department. Prepared under the direction of Surgeon General Lawson. (Copy in the Army Medical Library.)

Witt's conical rain gauge was furnished to those posts not already provided with that instrument.

In the same year as the second Army Medical Department contribution to meteorology, there appeared another important work from the Surgeon General's Office. It was: *Statistical Report on the Sickness and Mortality in the Army of the United States, compiled from the Records of the Surgeon General's and Adjutant General's Offices, embracing a Period of Twenty-one Years, from January, 1819, to January, 1839*, prepared under the Direction of Thomas Lawson, M. D., Surgeon General, Washington, 1840. This work considered the sanitary conditions at each of the Army's posts, detailed the more important incidents of their medical history, and concluded with a discussion of the relationship of climate and seasonal differences to mortality and the prevalence of such diseases as " fevers, diarrhœas, catarrhs, rheumatism, pulmonary diseases," etc.

Two years later Assistant Surgeon Forry republished his meteorological and statistical reports as a work entitled: *The Climate of the United States and its Endemic Influences*, New York, 1842. This work is considered a milestone in the advance in our knowledge of American climatology. Forry published an important paper at about this time: *Statistical Researches Relative to the Etiology of Pulmonary and Rheumatic Diseases, illustrating the Application of the Laws of Climate to the Science of Medicine; based on the Records of the Medical Department and the Adjutant General's Office*. Am. J. Med. Sc., Phila., 1841, n. s., i, 13-54.

Work of Professor Espy

Assistant Surgeon Forry resigned his commission in 1840 (he died in 1844) and was succeeded by another Pennsylvanian, James Pollard Espy (1785-1860). He was a distinguished meteorologist, a graduate (1808) of famed Transylvania University, Lexington, Kentucky, having grown up in Kentucky whence his parents removed while he was an infant. He was a teacher at the Franklin Institute, Philadelphia, and in 1836 won the Magellanic Prize of the American Philosophical Society. He lectured before the British Association for the Advancement of Sciences and the French

Fig. 6.

Map showing the location of United States Army posts in the first decade of the Medical Department's work in meteorology. At these stations the first official American meteorological observations were made. (From the *Meteorological Register* for the years 1826-1830 made under the direction of the Surgeon General, U. S. Army).

Academy of Sciences and in 1841 published, *On the Philosophy of Storms,* a work which brought him great renown.

In 1842 Congress appointed him meteorologist to the War Department, where under Surgeon General Lawson he continued work so successfully begun by Assistant Surgeon Forry.

Espy, soon after his appointment to the staff of the Surgeon General, sent out a circular letter urging the keeping of meteorological journals by voluntary observers throughout the country, by colleges, by high schools, by naval stations, by lighthouses etc., on blank forms prescribed for the Medical Department of the Army. He particularly requested cooperation in his efforts to develop the phases of storms. Espy charted on skeleton maps the observations taken as a storm was passing, thus hoping to determine its shape and size, whether round or oblong, and if the latter, whether it moved end foremost, sidewise, or obliquely. He also sought thus to determine the velocity and direction of the storm, the direction of the wind at and beyond its borders, the barometric and thermometric changes accompanying it, and the extent to which such changes were felt.

In 1843 Espy received journals from fifty observers who had noted barometric changes, and from some sixty others who had not recorded barometric changes. In the preparation of his first report to the Surgeon General, he utilized the observations of the months of January, February and March of that year. His report is illustrated by thirty beautifully engraved charts, showing the weather for the three month period. The title of this publication is: *First Report on Meteorology made to the Surgeon-General, United States Army*, Washington, 1843. Besides the thirty charts there were but four pages of text. On Espy's charts the direction and length of the arrows showed the direction and force of the wind, the points being near the places of observation. Rain or snowfall was indicated by figures in red. A long black line represented the various maxima of pressure as shown by the barometer, and a long red line indicated the various minima. (See illustration.) Espy deduced that storms travel from west to east and have a central line of minimum pressure, often of great length, and at right angles to the direction of its advance. The storm, he said, crosses the country like a

mighty line of battle, sometimes nearly straight, but generally with a convexity eastward at some point, as if an impulse were carrying it forward there at a greater rate than the average of thirty-six miles an hour. The wind sweeps inward from all directions toward the storm center, its force and the extent of the disturbance around the line of diminished pressure being proportioned to the suddenness and magnitude of the barometric fall. When such barometric fall is great the disturbance may extend for hundreds of miles, always being accompanied by rain or snow. Fluctuations are greater at the north than at the south. During the passage of a storm, the wind passes from easterly to westerly by way of the north in the northern portions of the country, and by way of the south in the southern parts. Storms usually begin in the far west beyond the sphere of the observations then made. Meanwhile, the area of maximum pressure, also linear and disposed longitudinally, retires eastwardly before the advances of the storm and disappears over the Atlantic Ocean as the storm line reaches the western border of New England, after which the line of maximum pressure reappears in the southwest, following up the storm that is now withdrawing beyond the Atlantic coast line. There is little wind near the line of greatest pressure, and in direction it is generally away from the line.

Prof. Espy concluded his report with recommendations that have, happily, been put into effect:

> It is highly desirable to surround storms and keep them constantly in view from their beginning to their end. Now, as the barometer generally sinks more during the passage of our great winter storms in the northern part of the United States than in the southern, is it not probable that the northern half of many of these storms is entirely beyond the bounds of our observations? And, as these storms certainly reach Newfoundland in their progress towards the east, is it not probable that they do not break up before they advance far into the ocean? May not some of them even reach the shores of Europe? Under these circumstances, would not the governments of England and France, if they were requested by the proper authorities, order the masters of the numerous steamers which now ply the Atlantic, to send copies of their journals to Washington City to be collated with those received now from so many other quarters?
>
> What high utilities to the mariner, and through the mariner to all mankind, might not be reasonably anticipated from such a system of widespread,

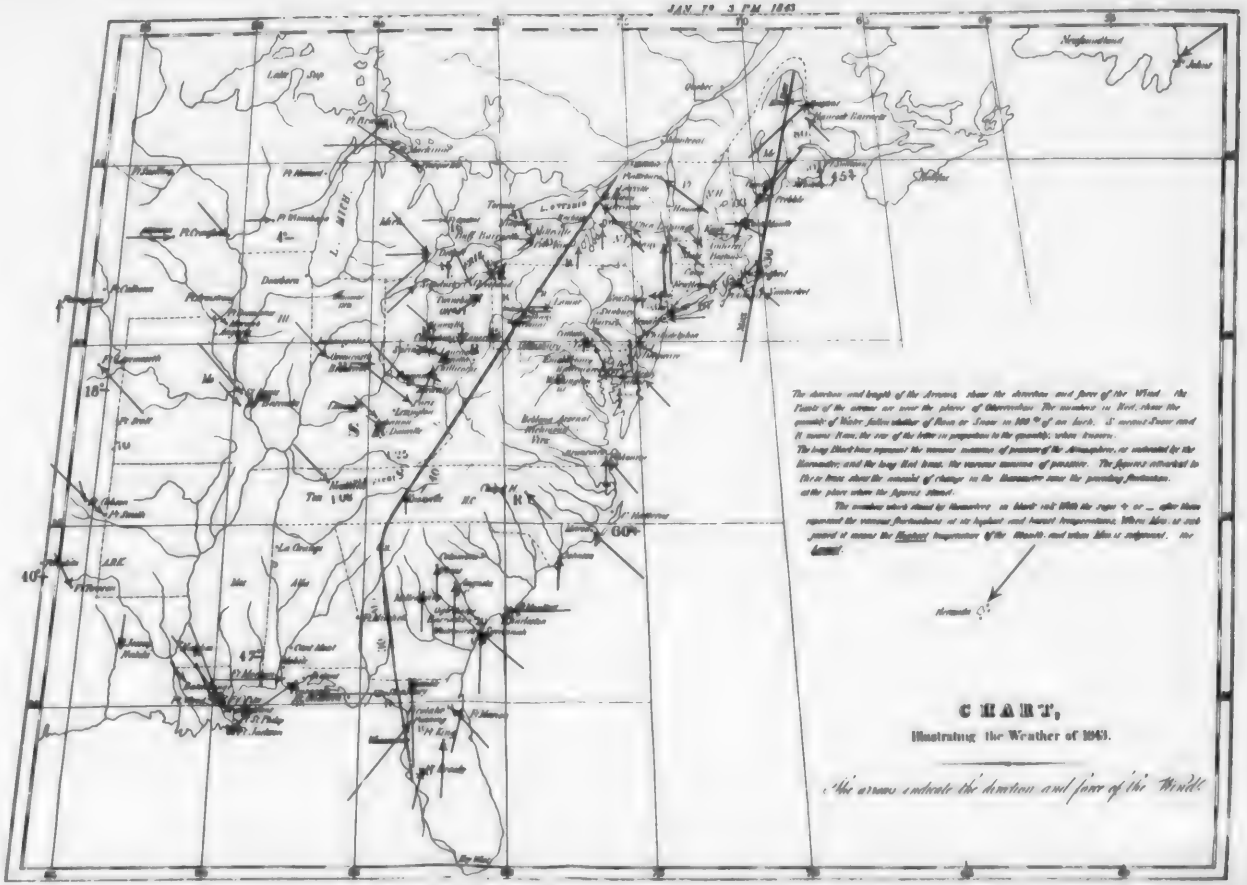

Fig. 7.

One of Espy's weather charts from his First Report on Meteorology made to the Surgeon General 1843

simultaneous observations, continued long enough to compare with each other, not merely the storms of different seasons, but the storms of different years.

What telegraphic communication would have meant to Espy! It was the only thing wanting to enable his genius to plan the very weather service that we have today.

The impetus given to the study of meteorology by Espy, building on the work of his predecessors, resulted in the appointment of a board of officers to formulate standard rules for making observations. The members of this board were: Surgeon Thomas Gardner Mower of Massachusetts, Surgeon John Meck Cuyler of Georgia, and Acting Assistant Surgeon H. A. Steinecke, (Smart, *vide infra*). Their report is: *Directions for Taking Meteorological Observations adopted by the Medical Department of the Army*, Washington, 1844. Surgeon Mower, who headed this board was the officer whose report on the outbreak of scurvy at Council Bluffs in 1820 is one of the best descriptions of its kind that we have. Parts of it are quoted by Ashburn, *A History of the Medical Department of the United States Army* (p. 41).

Espy, in addition to his duties in the Surgeon General's Office, War Department, was appointed meteorologist to the Navy in 1848. He made regular reports on meteorology to the Secretary of the Navy, the first of which appeared in 1850, consisting of 65 pages with 109 charts.

In 1852 Congress directed Espy to continue his work in connection with the Smithsonian Institution, which had already undertaken the collection of certain meteorological data. His chief contribution to the science of meteorology, says the Dictionary of American Biography, " was his convectional theory of precipitation, and his greatest addition to practical meteorology the institution of telegraphic bulletins giving knowledge at one place of the current state of the weather at various and widely different localities, thus laying the foundation of weather forecasting " (VI, 185).

The Medical Department's Third Report

In 1851 the Medical Department of the Army brought out the third of its series of meteorological reports. It was: *Meteorological*

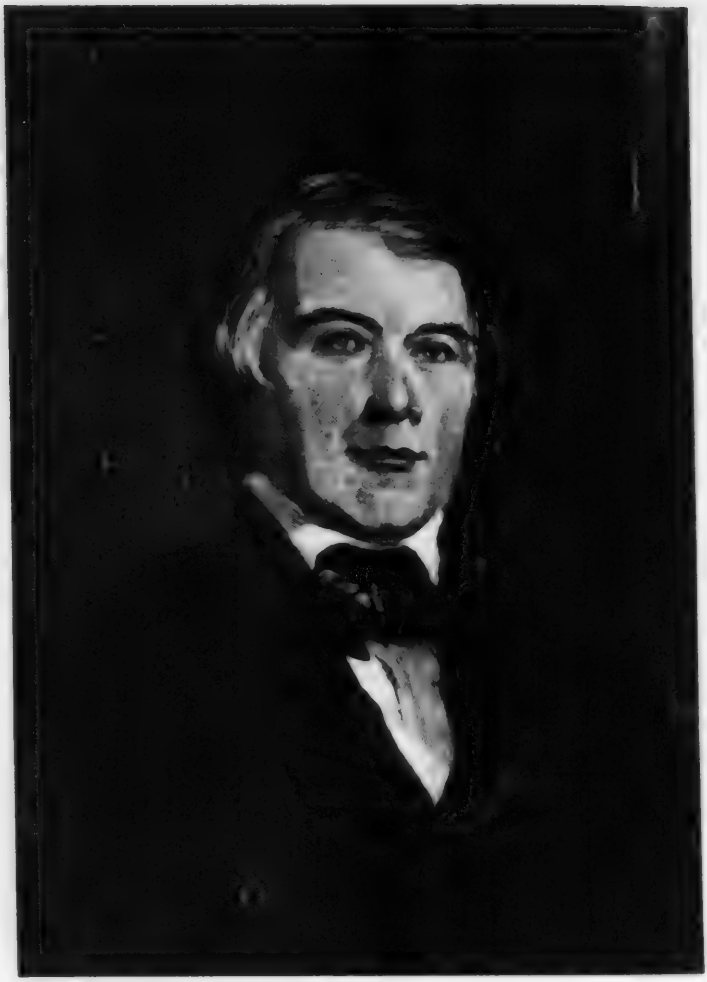

Fig. 8.

Prof. JAMES POLLARD ESPY (1785-1860) of Kentucky.

Foremost American meteorologist. Served under Surgeon General Lawson from 1843 to 1860. He laid the foundation of weather forecasting by his institution of telegraphic bulletins giving knowledge at one place of the correct state of the weather at various widely different localities. (Engraving in the Weather Bureau Library.)

Register for Twelve Years, from 1831 to 1842, inclusive, compiled from Observations made by the officers of the Medical Department of the Army at the Military Posts of the United States, prepared under the direction of Bvt. Brig. Gen. Thomas Lawson, Surgeon, U. S. Army, Washington, 1851. Unfortunately, notwithstanding the long delay in the publication of these observations, there was no collation of data or deduction of general results from the mass of facts presented. The tables embraced the records of some sixty-two posts from Key West Barracks, Florida to Fort Kent, Maine; and from Fort Sullivan, Eastport, Maine, to Fort Gibson in the Cherokee Nation, Arkansas.

The fourth of the Army Medical Department's series of meteorological publications was: *Army Meteorological Register for Twelve Years, 1842-1854*, compiled by Assistant Surgeons R. M. Coolidge and Lorin Blodget, Washington, 1855. These publications formed the basis of Forry's *The Climate of the United States and its Endemic Influence*, New York, 1842, and Blodget's *Climatology of the United States and of the Temperate Latitudes of the North American Continent*, Philadelphia, 1857. These works are considered milestones in American climatology.

The weather observations by Army surgeons from January, 1819 to January 1841, were made thrice daily, at 7 a. m., 2 p. m., and 9 p. m. In 1842 there was another change; observations were required at sunrise, 2 p. m., sunset, and 9 p. m. In the period 1843 to 1855 the observations were at "a little before sunrise," 9 a. m., 2 p. m., and 9 p. m. A study of the records at this time showed that the mean of the observations taken at 7 a. m., 2 p. m., and 9 p m., more nearly approximated the true daily mean than did the means of the four daily observations. Therefore the Surgeon General ordered that the observations again be made as in 1819, i. e., at 7 a. m., 2 p. m., and 9 p. m.

The Army Medical Department Cooperates with Other Scientific Bodies

During the period when Army surgeons were recording meteorological data under the direction of the successive Surgeon Generals,

METEOROLOGICAL REGISTER

FOR TWELVE YEARS,

FROM 1831 TO 1842 INCLUSIVE:

COMPILED FROM

OBSERVATIONS

MADE BY THE

OFFICERS OF THE MEDICAL DEPARTMENT OF THE ARMY

AT THE

MILITARY POSTS OF THE UNITED STATES.

PREPARED UNDER THE DIRECTION OF

BREVET BRIG. GEN'L THOMAS LAWSON,

SURGEON-GENERAL UNITED STATES ARMY.

ARMY MEDICAL LIBRARY
26/842
WASHINGTON, D. C., U.S.A.

WASHINGTON:

C. ALEXANDER, PRINTER,

F STREET, NEAR THE NAVY DEPARTMENT.

1851.

Fig. 9.

Title-page of the third *Meteorological Register* of the Medical Department, United States Army, Washington, 1851. Prepared and published under the supervision of Surgeon General Lawson. (Copy in the Army Medical Library.)

the Smithsonian Institution, the Franklin Institute of Philadelphia and the American Philosophical Society were all at work in this field, and bearers of some of the greatest names in American science were making scientific history. Surgeon General Lawson cooperated with these scientific bodies in meteorological work.

Lieutenant Matthew Fontaine Maury, U. S. Navy, who was superintendent of the United States Naval Depot and Observatory from 1844 to 1861, collected data about the weather of the seas. Through the cooperation of ship captains he built up the mass of knowledge concerning ocean climates, *inter alia*, and earned the title "Pathfinder of the Seas" now accorded him. Fortunately marine meteorology was firmly established before the outbreak of the War Between the States, for Maury had other duties, and became a commander in the Confederate States Navy. In 1862 he was sent as special agent of his Government to England, where his fame made him an effective spokesman for the Southern cause.

The next publication of the Army Medical Department, that contained meteorological material, was issued in the same year as Blodget's *Climatology*. It was: *Statistical Report on the Sickness and Mortality of the Army of the United States compiled from the Reports of the Surgeon General's Office, embracing a period of sixteen years from January, 1839, to January, 1855*, prepared by R. H. Coolidge, Assistant Surgeon, U. S. Army, Washington, 1856. The volume included a table for each of a hundred and fifty-nine posts of the army, giving the mean results of observations of temperature for each month, season and year during the entire period of the observations at each. The rainfall, wind and weather were given in another series of tables.

Similar statistical reports, also prepared by Surgeon Richard Henry Coolidge of New York, were issued in 1860, covering a five year period from January 1855 to January 1860.

The publication of Surgeon Coolidge's reports in 1860 brings us down to the period of the War Between the States, and to the outstanding contributions of Surgeon Albert James Myer. His career is worth reviewing in some detail.

Fig. 10.

Surgeon ALBERT JAMES MYER (1828-1880) of New York.

Brigadier-General and first Chief Signal Officer, United States Army. Father of the Weather Bureau. Fort Myer, Virginia, is named in his honor. (Steel engraving in the collection of the Signal Corps, U. S. Army).

Surgeon Albert James Myer, U. S. A.

Albert James Myer, was born at Newburg, New York, 20 September 1828, and received his early education in the public schools of Buffalo. While still young he was employed in the local telegraph office, where in time he became an expert operator. His interest in signals dated from then. With the money he earned and assistance from his aunt, who mortgaged her home to help educate him, young Myer entered Geneva (now Hobart) College where he graduated in 1847. He took his M. D. at the Medical School of the University of Buffalo in 1851. Dr. Auston Flint, who thought his health undermined, persuaded him to work for a time in Canadian lumber camps to regain it. Later he secured a position as plantation physician near Charleston, South Carolina. He passed the required entrance examination for admission to the Army Medical Department and was commissioned Assistant Surgeon on 25 September 1854. He served successively at Fort Wood, Bedloes' Island, New York Harbor (where the Statue of Liberty now stands) and at Fort Duncan, Texas, a hundred and fifty miles from San Antonio. At these posts he saved every penny and managed to repay his aunt for her loans to him while a student.

While stationed in the Indian country (1858), he became deeply interested in the system of beacon lights and smoke signals used by the Indians to send messages from hill tops and mountains. As a result of his studies he devised a system of signaling with flags by day and with torches by night, whereby messages could be sent many miles with rapidity and accuracy. In April of this year he was ordered to New York City, and soon thereafter visited Washington where the military authorities regarded his proposed signal system with favor and he was given three months leave to develop and perfect it. Between April, 1858, and August, 1859, he demonstrated his system at Fort Hamilton, New York, and Old Point Comfort, Virginia. In the former year he published a preliminary volume on his work, which subsequently became the basis of his famous *Manual of Signals for the Army and Navy* which did not appear until 1868. His demonstrations were recognized as of practical value and on 27 June 1860 he was appointed a major and chief Signal Officer. In

June 1861 he was made signal officer on the staff of General Benjamin Franklin Butler, sometimes known as "Spooney" or "Beast" Butler, commanding Fortress Monroe, Virginia. Myer afterwards held similar appointments on the staffs of Generals McDowell and McClellan. He took part in nearly all of the engagements during the Peninsular campaigns.

In November 1862 he was placed in charge of the Signal Office in Washington, and served throughout the remainder of the War Between the States with great credit. On 2 July 1862 he received the brevet rank of lieutenant-colonel in recognition of his services at the battles of Hanover Court House and Malvern Hill. On 3 March 1863 he was appointed colonel and Chief Signal Officer of the Army. His appointment expired on 21 July 1864 and, owing it is said to the personal animosity of Secretary of War Stanton, he was not reappointed. His memorial, with several supplements to the U. S. Senate, dated 20 January 1865 sets forth all the details of his work and pretty clearly shows that the jealousies sometimes found in the military service had caused his return to his old rank of major. The President of the United States personally took his part and on 28 July 1866 he was restored to his colonelcy. On 13 March 1869 he was brevetted brigadier-general, "for meritorious services in organizing, instructing and commanding the signal corps of the Army and for its special service on 5 October 1864, the day on which the post and garrison of Allatoona, Georgia, and a most valuable depository of provisions there, were saved by troops brought up by signals just in time to defend it, the message having been sent over the heads of the enemy when communication in any other way was impossible." (Heitman, *Hist. Reg. & Dict. of U. S. Army*, I, 739.) Myer's success with his system of signalling in the field is in contrast to that of the Confederate Army. The Confederate signals were understood by the enemy. When Lieutenant-General Polk was killed, the Union signal officers knew of it almost immediately for they read the signaled question of the Confederate surgeon who asked when an ambulance would be sent for the soldier-bishop's body.

A scientific mind like Myer's appreciated the value of the meteorological observations which had been made by the Medical Department of the Army for half a century. He had the ambition to make

these observations of practical value to mankind. In 1869 he outlined a course of usefulness for the military organization of the Signal Service in the way of weather reporting and storm signalling. In this he was using the data from Espy's charts, as well as the work of Professors Cleveland Abbe of Cincinnati and Increase Allen Lapham of Milwaukee, who in 1868 had made practical use of Espy's publications in making weather forecasts. In 1870 President Grant approved a joint resolution of Congress:

> That the Secretary of War be and is hereby authorized and required to provide for taking meteorological observations at the military stations in the interior of the continent and at other points in the states and territories of the United States, and for giving notice on the northern lakes and on the sea coast of magnetic telegraph and marine signals of the approach and force of storms. Act Approved 9 February 1870.

Myer Trains Officers in Meteorology

General Myer had now the problem of educating the officers of his corps in meteorology. In this he enlisted valuable aid in the persons of Professor Joseph Henry of the Smithsonian Institution, Acting Assistant Benjamin Franklin Craig of the Army Medical Department, known as one of the best chemists in the country, Charles Anthony Schott of the Coast Survey, Rear-Admiral Thornton Alexander Jenkins of the U. S. Navy, Professor Elias Loomis of Yale, Mr. T. B. Maury of New York, Professor Cleveland Abbe of Cincinnati, and Professor Increase Allen Lapham. One of Myer's earliest commissioned assistants was Lieutenant Adophus Washington Greely, who was one day to succeed Myer as Chief Signal Officer of the Army and win fame as an Arctic explorer.

This is not the place to give a detailed account of General Myer's many accomplishments as Chief Signal Officer of the Army. He never lost the physician's point of view, and in all his work sought to advance the idea of using his knowledge of climates and weather forecasting to prevent or diminish the incidence of disease. Some of his more important pieces of work may be mentioned. He established sixty-six stations where storms were studied and, using data already being recorded by the Army Medical Department, as well as

anemometric readings, he was able to give the country its first storm signals. By means of announcements in the newspapers, "Farmers' Bulletins" displayed in Post Offices, signal flags, etc., the public was warned of coming bad weather. His predictions of early and late frosts were of value to physicians as well as agriculturists. In 1872 he began to require reports relative to the stages of water in the rivers and by bulletins was able to warn the public against floods.

In 1875 when telegraphic reports began to be required, this service assumed the great importance which it occupies today. Special studies of the influence of climatic conditions on crops have aided farmers throughout the country. In 1873 Myer represented the United States at the International Meteorological Congress in Vienna, and his recommendations as to an international exchange of data were adopted. Professor Abbe called this "The finest piece of international cooperation in scientific work that the world has ever seen" (E. R. Miller, *American Pioneers in Meteorology*, Monthly Weather Review, 1933, lxi, 189-193). About the same time he arranged cooperation with the Life-Saving Service of the Treasury Department, with a resulting increase in that service's efficiency. In 1871 Myer's colleagues made extensive observations at high altitudes, as well as meteorological studies of the upper air by means of small free balloons. Clouds were studied in 1870 and early photographic records begun. The service in 1871, and later, cooperated under Myer's direction, in making observations in the Arctic regions. Myer revived the collection of marine intelligence which had fallen into abeyance after Maury threw in his lot with the Confederacy.

In all this outline of General Myer's climatological and meteorological work we must not forget that it was still the Army medical officer who was his chief source of information. By 1860 the observations of the surgeons at the various Army posts throughout the United States had filled sixty-four large folio volumes in the Surgeon General's Office. In 1870 the work of collating and evaluating the medical officers' reports was taken over by the Signal Service, in accordance with the Act of Congress known as the Paine Bill. In 1890 the Weather Bureau, which owed its birth to Myer, became a part of the Department of Agriculture. Still the Army surgeons continued their reporting. It was some years after the Spanish-

Fig. 11.

Dr. Clement Alexander Finley (1797-1879) of Ohio.

Surgeon General, United States Army, 1861-1862. Served nearly fifty years as an Army medical officer, having charge of the meteorological service during 1861 and 1862. Veteran of the Mexican, Indian and Civil Wars. (Portrait in the Army Medical Library).

American War, that the work was largely given up by medical officers, but even so, some stations continued it. At the United States Military Academy, West Point, the Surgeon was responsible for this work until 1927! (Ashburn, 388.)

Surgeon Generals Finley and Hammond Succeed Lawson

General Lawson was succeeded as Surgeon General of the Army by Dr. Clement Alexander Finley (1798-1879), of Ohio, who held the office from 1861 to 1862. Finley has been described as handsome, complaisant, self-satisfied, vain and incompetent. Perhaps this is all unfair, and Finley blamed for things that he was without power to help, for he was appointed at a most trying time, when the U. S. Army was found unprepared for war long envisaged. Dr. Finley had a good record in the Mexican and Indian wars, but was hardly equal to the task of a chief of the Medical Department in a major emergency. He applied for retirement and left the active service in 1862.

Finley's successor was Dr. William Alexander Hammond (1828-1900), of Maryland, one of the most distinguished men who has held the chief office of the Medical Department. He is a tragic figure, a man of brilliant record in the military service who in 1857 won the American Medical Association's prize for his essay on *The Nutritive Value and Physiological Effects of Albumen, Starch and Gum when Singly and Exclusively Used as Foods.* In 1859, in collaboration with Dr. S. Weir Mitchell, he published extensive experiments on South American arrow poison. He resigned from the Army in 1860 to accept the chair of anatomy and physiology at the University of Maryland, but reentered the service, after again passing the entrance examination, at the outbreak of the War Between the States. He was a lieutenant when chosen to be Surgeon General. "He had large vision, clear understanding, and unbounded energy, and he brought them all to bear upon the task of improving the Medical Department," (Ashburn, 74). He established the Army Medical Museum, now the largest institution of its kind in America and possibly in the world; and he laid the ground work for the publication of the medical and surgical history of the

Fig. 12.

Dr. William Alexander Hammond (1828-1900) of Maryland.

Surgeon General, United States Army, 1862-1864. Directed the work of meteorological recording in the War Department. Surgeon Myer, later Chief Signal Officer of the Army, collaborated with him. One of the most distinguished officers who has held the office of Surgeon General. Father of the Army Medical Museum. (Portrait in the Army Medical Library.)

war. He made other recommendations for the good of the service, many of which have been put into effect. His support of the meteorological work of his officers was one of these. He had difficulties with Secretary Stanton, a man not noted for breadth of vision or depth of thought and one who had already given trouble to the Medical Department. This is not the place to discuss Hammond's fate. Suffice it to say that he was removed from office in 1864 following a trial by court martial. Though he was later vindicated he was naturally embittered for the rest of his life. His assistant, Dr. Joseph K. Barnes, was made Surgeon General in his stead in 1864 and held that office until his retirement for age in 1882, the year before his death.

Surgeon General Barnes

Surgeon General Barnes (1817-1883), a native of Pennsylvania, was the last Surgeon General of the Army who had direct charge of the meteorological records. He carried forward the improvements initiated by Hammond, and, having the confidence of Secretary of War Stanton, he was able to accomplish what Hammond could not. Under Surgeon General Barnes' direction there was issued: *General Meteorological Directions, and Explanation of the Barometer in use in the Medical Department, U. S. Army*, Washington, 1868. General Barnes attended Secretary Seward in his last illness and gave what help he could to Presidents Lincoln and Garfield when felled by the assassins' bullets.

In all, six Surgeon Generals of the United States Army had charge of the reporting of the weather: Tilton (1813-1818), Lovell (1818-1836), Lawson (1836-1861), Finley (1861-1862), Hammond (1862-1864) and Barnes (1864-1880). All are not entitled to the same degree of credit for the accomplishments of their departments in meteorology, but to them all belongs the credit for continuing it. Be it remembered that if any one of them had failed to be interested in this important work, or had allowed it to lapse and the series of records to be broken, meteorologists and climatologists of today would be deprived of the splendid records that the Medical Department of the United States Army has bequeathed to them. Therefore all honor to these chiefs.

Fig. 13.

Dr. Joseph K. Barnes (1817-1883) of Pennsylvania.

Surgeon General, United States Army, 1864-1880. Served in the Seminole, Mexican and Civil Wars. Directed the publication *The Medical and Surgical History of the War of the "Rebellion."* Was responsible for the collection of meteorological data before General Myer's appointment, and thereafter in part. He attended both President Lincoln and President Garfield after they were stricken down by assassins' bullets. (Portrait in the Army Medical Library.)

Army Meteorological Work Turned Over to General Myer

In 1874 Surgeon General Barnes and Professor Joseph Henry, Secretary of the Smithsonian Institution, decided to turn over to General Myer all monthly reports of their two offices, thus concentrating the climatological and meteorological work of the country in the Signal Office. This decision, on the part of the Smithsonian Institution, at least, was not wholly voluntary, for the financial panic of 1873, had tied up their funds, then in a private bank, and they had not wherewithal to continue meteorological work. (Cf. E. R. Miller, *American Pioneers in Meteorology*, Monthly Weather Rev., 1933, lxi, 189-193.)

In the same year (1874) meteorological observations were discontinued at those military stations near which the Weather Bureau had installed stations. But, even so, there were some fifty Army posts still required to continue meteorological recordings. It was only 1875 that the Signal Service office was formally established as one of the bureaus of the War Department, with a chief directly under the Secretary of War. General Myer, therefore, became the first Chief Signal Officer of the United States Army. The name Signal Service was changed to Signal Corps on 24 February 1880.

In 1875 General Myer's office began to issue daily international weather maps. In 1879 he represented the United States at the International Meteorological Congress in Rome, and presented an important report on the weather service in his country. He gave an account of his work to the King of Italy in a personal interview. In 1880 he was appointed brigadier-general in recognition of his splendid services, thus acquiring a rank which he had previously held by brevet only. The honor came to him at the end of his life, however, for he died while on a visit to his native Buffalo on 24 August 1880, little more than two months after his promotion.

Myer is given his just due however by a grateful scientific world. Fort Myer, Virginia, formerly known as Fort Whipple, was named in his honor and he may well be considered one of that select little group of stalwart military surgeons who have advanced medical science and added laurels to the Army Medical Department. His position in the field of meteorology is thoroughly recognized. As Eric R. Miller says: "The credit of organizing the meteorological

service belongs solely to Chief Signal Officer Albert J. Myer" (Miller, *Tradition versus History in American Meteorology*, Monthly Weather Rev., 1930, lviii, 65-66).

Publications About the Army Medical Department's Part in American Meteorology

Though there has, of late years, been an unfortunate lack of recognition, even on the part of Army medical officers, of the importance of their department's contributions to climatology and meteorology, it was not always so. In 1843 a paper was read before the American Philosophical Society by Surgeon Thomas Gardner Mower (1790-1853), entitled: *Notice of the Meteorological Observations now Making at the Military Posts of the U. S.*, Proced. Am. Philosoph. Soc., Phila., 1843, iii. 158-162. He reported, among other things, that on the Atlantic slope only two barometers were placed at any considerable distance from the ocean, at Carlisle Barracks, Pennsylvania, and Augusta Arsenal, Georgia.

In 1876 Surgeon Joseph Janvier Woodward, well-known as chief editor of the medical volumes of the monumental *Medical and Surgical History of the War of the "Rebellion,"* delivered an address before the International Medical Congress in Philadelphia, entitled: *The Medical Staff of the United States Army and its Scientific Work* (*Trans. Int. Med. Congr.*, Phila., 1876, Phila., 1877, 286-304). He said: "As intimately connected with the question of disease, the medical officer in charge of each post is required to keep a meteorological register, a transcript of which must be furnished to the Surgeon General at the end of the month." The congress to which Surgeon Woodward spoke was attended by some of the greatest medical men of the world, including Lord Lister. It was at this same congress that Lister advocated aseptic rather than antiseptic surgery.

At the International Meteorological Congress at Chicago in 1893, Major Charles Smart of the Medical Corps, U. S. Army presented an interesting study: *The Connection of the Army Medical Department with the Development of Meteorology in the United States.* This appeared in the Transactions of the Congress published as Bulletin No. 11, part II, U. S. Department of Agriculture Weather

Fig. 14.

Dr. Thomas Gardner Mower (1790-1853) of Massachusetts.

Surgeon, United States Army. Chairman of the Medical Department's board of officers to formulate standard rules for making meteorological observations, 1850. Mower is also known for his vivid description of the outbreak of scurvy, 1820. (Portrait in the Army Medical Library.)

Bureau, 1895, pp. 207-216. An abstract, though not a satisfactory one from a medical officer's viewpoint, was published in the *American Meteorological Journal*, 1893-4, x, 372-373.

The most recent paper along this line was by Dr. George Martin Kober, some-time Dean of Georgetown University Medical Department, and an ever loyal son of the Army Medical Department in which he was an enlisted man in his youth. His paper, which is largely devoted to the life work of Myer, is: *General Albert J. Myer and the United States Weather Bureau*, The Military Surgeon, July 1929, lxv, No. 1, 65-83. In it he tells of his experience as a clerk at the Post Hospital at Carlisle Barracks, Pennsylvania in 1867. It was his duty to make and record the daily observations of the weather.

> In the center of the hospital grounds stood the flagstaff with a weather cock, also a kiosk for the barometer, dry and wet bulb thermometers, and a suitable platform for snow and rain gages.
>
> These observations were made at 7:00 A. M., 2:00 P. M., and 9:00 P. M., and involved careful reading and recording of the thermometer, barometer, hygrometer, the direction and force of the winds, clearness of the sky, and fall of rain or snow. Monthly reports were rendered to the Surgeon General's Office. The work appealed to my youthful imagination very greatly."

Dr. Kober's "youthful imagination" was sufficiently stimulated, it may be added, to cause him to become one of the leading students of the atmosphere in relation to health. An abstract of his work in this field is to be found in *Reminiscences of George Martin Kober, M. D., LL. D.*, 1930, I, 166-186.

Conclusion

The Medical Department of the United States Army has made certain outstanding contributions to science. It has assembled the greatest collection of medical literature that the world has ever known, and provided a catalogue for it that is the international standard of medical bibliography. It has developed the most important medical museum in America, and possibly in the world, wherein some of the leading medical societies study and preserve their records and pathological material. It furnished the first American Pharmacopœia. It first brought vaccination against smallpox

to the United States. It first saw the importance of ventilation and the ill effects of overcrowding. It was first in the study of the physiology of digestion. It showed that typhoid fever may be spread by contact, and later was first in America to use prophylaxis against this disease. It proved that the mosquito transmits yellow fever and dengue. Without its successful campaign against yellow fever and malaria there could have been no Panama Canal. It led in the early teaching of bacteriology. It established the first school of public health in America—the Army Medical School. It has led in thoracic and maxilo-facial surgery. Its Tropical Medicine Board has made important advances in this field, working first in the Philippines and later in Panama. In malariology it has made highly important discoveries, showing the causes of relapses and explaining the existence of carriers. It first used liquid chlorine in water purification. Its studies of both protozoal and bacterial dysentery were among the earliest made. It was first in America in the prevention of venereal disease by chemical prophylaxis. It gave ethnologists and anthropologists the first comprehensive data on the Indian and the Filipino. It initiated periodic physical examinations to detect unsuspected disease. It has made significant contributions to our knowledge of pellagra, beri beri and other deficiency diseases. Its officers have successfully waged wars overseas against cholera, plague, typhus fever, and uncinariasis. It made the first studies on the bacteriology of dental caries. In veterinary medicine it must be credited with some of the most important advances of the last decade. Nor are even these all that could be mentioned.

Thus, when we consider the significance of meteorology today and the importance of the work of the Weather Bureau in the lives of every inhabitant of the country, we may proudly place the work of Tilton and Lovell, of Espy and Myer, beside that of the other great men of our Corps. For—

What is it moulds the life of man?
The weather.
What makes some black and others tan?
The weather.
What makes the Zulu live in trees,
And Congo natives dress in leaves
While others go in furs and freeze?
The weather.

THE HISTORY OF THE ENEMA WITH SOME NOTES ON RELATED PROCEDURES

(Part II)

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The instrument passed through frequent transitions from the earliest time to the beginning of the nineteenth century when it was destined to become a household remedy. Towards the end of the eighteenth century the frivolous attitude and ridicule in which the enema was held gradually disappeared. A far saner aspect with regard to this treatment was manifested and the so-called "clyster mania" vanished. The treatment assumed a more scientific point of view under the direction of the medical profession, which now prescribed the indications, the form and the character of the procedure.

The introduction of rubber about the middle of the eighteenth century rendered it possible to apply this substance as a useful part of the outfit.

Soon after the discovery of America, it became known that certain South American Indians had been familiar for a long time with the use of a resilient and elastic substance, later termed caoutehouc or rubber. About 1735 this substance was introduced into various parts of the world and gradually was utilized for certain purposes and adapted for parts of the enema apparatus. However, it was not until after the discovery of vulcanization by Charles Goodyear in 1839 that its great value became recognized in industry and in the manufacture of the major part of the enema outfit.

The piston syringe was certainly a great advance over the primitive bladder with its various additions. But it also had its disad-

vantages inasmuch as it was not perfectly calibrated; the piston did not always glide smoothly and it was difficult at times to empty the contents at an even rate. Its application was made difficult by the occasional resistance on the part of the patient. Boicervoise,[87] a pewterer, devised a syringe with an attachment by means of which it could be held firmly so that the contents could be emptied at an even rate as well as more gently and smoothly. This type of syringe was an improvement over the older forms and was recommended by the medical profession. However, the enema apparatus was by no means perfect and further improvements in its structure were devised.

Instead of the syringe, French peasants often used a pig's bladder with a tube attachment. In America the rubber enema bag with a connecting tube and an ivory tip were utilized, while enemas were still being administered generally with a syringe on the continent of Europe. However, soon after the beginning of the nineteenth century the metal container with rubber tube and tip attachment became much more popular.

In 1832 a pharmacist of Paris, M. Petit,[88] imported the clyster syringe and clyster pump into France. These had already been used in England. It was about this time that Leroy d'Étiolles,[89] a well known surgeon and an inventor of surgical instruments conceived the idea of replacing the old syringe by the " Clysoir " or " clysopompe," a modified and improved clyster syringe or pump connected with an intermediate tube a meter in length, which could be operated alone or with the aid of an assistant. In 1848 the irrigator of Dr. Equisier [90] appeared and was approved by the " Académie Nationale de Médecine." It became and remained very popular over a long period of time. Finally this was largely replaced by the enema container with rubber tube attachment ending in a tip and emptied by the aid of gravity.

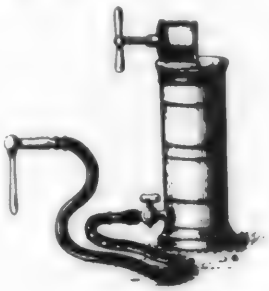
[87] Cabanès et Witkowski, *loc. cit.*, pp. 104 and 88.

[88] M. Petit, see de Graaf, *L'Instrument de Molière* (*loc. cit.*), p. 54.

[89] D'Étiolles, J. Leroy, *Exposé des divers procédés employés jusqu'à ce jour pour guérir de la pierre sans avoir recours à l'opération de la taille*, Paris, 1885, chapter V, p. 83.

[90] Equisier, C., " Rapport sur un appareil nommé irrigateur inventé par Equisier," *Bulletin de l'Académie Nationale de Médecine*, Vol. 14, 1848-1849, Paris, Séance 21 Novembre.

The Higginson and Kennedy[91] syringes were also frequently employed. These consisted of a pear shaped bulb with rubber tube attachments on opposite sides. The one was arranged with suction valve so as to draw the fluid which was to be injected into the bulb and the other so as to force it out through the opposite rubber tube terminating in the rectal tip. By means of alternate compression, the bulb would fill and the requisite amount of fluid could be injected. This form of syringe is still utilized today to a minor extent. The improved apparatus recommended by de Graaf was utilized in France but became less and less popular and a period of almost two cen-



Irrigateur d'Esmarch.

Fig. 15.

[From *Glossaire médicale*, C. Naud, Editeur, Paris, 1902, p. 171]

turies had passed by before the full significance of the flexible intermediate tube again became fully recognized.

M. Heyman,[92] a tin-smith, added a further improvement to the syringe on a different basis. This instrument, which he termed a pump, consisted of a hollow cylinder of a diameter of at least twice that of the ordinary syringe but only half as high. Another cylinder fits quite firmly in the first one; it contains a central opening through which the fluid is forced up as the cylinder exerts pressure upon it. This tube terminates in a nozzle which is surrounded by a large mushroom-shaped tin piece upon which a pad of rubber can be

[91] Shepard, W. L., "Two New Forms of Enema Apparatus," *British Med. Jour.*, 1872, Vol. 1, p. 670.

[92] Phillippe, *loc. cit.*, p. 107.

placed. After filling the syringe the patient sits upon the pad and as the result of pressure of the body the fluid is forced into the bowel.

Resembling this instrument in some respects is the well known J. B. L. Cascade Internal Bath which is utilized extensively in this country. This apparatus [93] was originated and introduced by Dr. Chas. A. Tyrrell in 1894. It consists of a cloth-inserted rubber bag holding five quarts of water with central injection tip containing numerous side perforations but no end opening. A side handle

Fig. 16.

Higginson Syringe

[From W. Kerr Russell, *Colonic Irrigation*, 1932, p. 57]

By courtesy of the William Wood and Company.

allows the regulation of the intensity as well as affords a means of stopping the inflow. The patient sits in a normal posture upon the rubber bag and the tip having been inserted, the dome of the appliance fits snugly against the anus and the weight of the body applies pressure sufficiently for complete entrance of the injection fluid into the bowel.

Attention must again be directed to the elaborate discussion of Colson [47] on the enema which he published as a thesis in Paris in 1867. In this treatise of fifty pages, the history, physiology, pharmacology, and therapeutics related to the enema are fully described. The indications for the use of nutrient enemata as well as an evaluation of their limitations are noted and the author likewise calls attention to the method of administering by bowel certain prepara-

[93] Tyrrell, J. B. L., Cascade, N. Y., Personal Communication.

tions which are apt to produce nausea if given orally. The dangers of injections of tobacco fumes so commonly used in those days are noted and Colson cautions against their employment.

Numerous references to the clyster are to be found in the German medical literature as far back as the sixteenth century. We have already referred to Fabry of Hilden,[93] who utilized a bladder with a hollow reed attachment as an enema apparatus. Heinrich Rantzau,[94] in a work published in 1587, states that enemata are the safest of remedies and can be utilized without danger each week and with benefit. They soften and moisten the constipated stools, cleanse and wash the intestines and can be employed with beneficial effect in any disease and may otherwise restore strength and health. Rantzau recalls the legend of the discovery of the enema as due to the stork.

He tells the story in this fashion. At the onset of ill health and when disturbed by abdominal distress, according to him, the bird proceeds to the sea and gulps in the salt water through its long neck and injects it with its bill into its anus in consequence of which the constipated bowel is again relieved. Following this discovery the method was followed by physicians and as a consequence a variety of forms of injections have been introduced such as those to relieve constipation, those for irrigation of the bowel to relieve pain, as occurs in colic and those to furnish strength given as nutrient enemata. On this account no individual should object to the use of so splendid and useful a procedure. He describes a variety of solutions to be utilized for injections with indications for their use. It is interesting that as late as the 16th century Rantzau should still have adhered to the ancient story of the stork concerning the origin of the enema. Among other German authors who were familiar with the use of the enema are Elsholtz [95] who employed the procedure with success. He published an illustrated scientific treatise and described new forms of injections and according to Garrison,[96] was

[94] Rantzau, Heinrich, *De conseruanda valetudine. Das ist: Von Erhaltung menschlicher Gesundheit allen Menschen hohen und niedrigen Standes.* In Latin and translated into German by Johannes Wittichius Vinariensis, Leipzig, 1587, pp. 114, 115, 116.

[95] Elsholtz, Johann Sigismund, *Clysmatica nova; oder neue Clystier-Kunst*, Berlin, 1665.

[96] Garrison, *loc. cit.*, 3rd edition, p. 273.

the first to introduce intravenous injections in man. Rhodius,[97] Schwarz,[98] Henne,[99] Meyer,[100] Pfaff,[101] Quelmaltz,[102] Schaefer [103] and Nicolai [104] were prominent among those whose publications on the enema appeared during the eighteenth century.

About this time Johann Kämpf [105] expounded the doctrine of " infarctus." By " infarctus " Kämpf recognized the presence of impacted feces which he believed originated in the thickening of the humors in the portal vessels and intestine " when the former became filled, stuffed or distended universally or locally by the blood delayed in its circulation and finally became stagnant." There are two kinds of " infarctus," the black bilious and mucous. These are of varying consistency, soft as mucus, to firm as flesh, and indeed as hard as stone and they are so dangerous that they must be expelled. From this theory a widespread clyster fashion developed. Lords and ladies vied with each other in belaboring their infarctus and in practicing clysterization. The author of this doctrine supplied a universal procedure and gratified the apothecaries by the use of the herbs required. The use of the enema furnished occupation and diversion for the laity.

Friedrich Hoffmann [106] of Halle, a highly distinguished physician of his day, likewise recommended the use of enemas for various conditions in the first half of the eighteenth century. In his " Practice

[97] Rhodius, Ambros., *De recta clysterum glandium et vomitoriorium administratione*, Wittel., 1612.

[98] Schwarz, J. Casp., *Clystiere als ein altgemeines Hausmittel in allen vorfällen sicher zugebrauchen*, Ham., 1723.

[99] Henne, J. L., *De clystere febrium exanthematicarum remedio non minus tuto quam efficaci*, Wittenbergae, 1756.

[100] Meyer, J. C., *De clysmatibus*, Göttingen, 1786.

[101] Pfaff, J. E. A., *Diss. exhibens historiam clysterum pathologico-therapeuticam*, Jenae, 1787.

[102] Quelmaltz, S. T., *De clysmatibus frigidis*, Leipzig, 1751.

[103] Schaefer, C. F. G., *De noxa et abusu clysmatum*, Wittenbergae, 1788.

[104] Nicolai, E. A., *De virtute et usu clysterum ex aceto*, Jenae, 1783.

[105] Kämpf, Johann (father and son; father died in 1753, the son lived by the same name [1726-1787]), see Joh. Hermann Baas, *Outlines of the History of Medicine*, trans. by H. E. Handerson, New York, 1889, p. 623; also Joh. Hermann Baas, *Grundriss der Geschichte der Medizin*, Stuttgart, 1876, p. 492.

[106] Hoffmann, Friedrich, *Medicina Rationalis Systematica*, 9 Vol., Halle, 1718-1740; also Lewis, William, *System of the Practice of Medicine*, revised and completed by Andrew Duncan, London, 1783, Vol. I, pp. 510, 324, 467, 503, 283.

of Medicine" which was translated from Latin into English in 1783 he states that in colic, "when the rectum and part of the colon are strongly constringed so as not conveniently to receive a clyster, foment the whole abdomen with warm oil." "In a woman with colic and spasmodic disorders," he states, "a bladder of warm liquor is now applied to the abdomen and clysters of water with syrup of marshmallows and nitre injected every three hours."—"In all headaches from whatever cause, the cure is to be begun with clysters."—"In volvulus clysters of warm water with syrup of marshmallows are of great service in dissolving the excrement and relaxing the rigid intestines." "In nephritis if the belly be much bound a clyster of milk, oil, honey and nitre is to be injected."

Wohts[107] in 1753 advised enemas to be administered either by means of a syringe or through an enema bag prepared from a pig's or beef's bladder to which a tube was attached. He also presented specific indications, contra-indications and prescribed formulas for the preparation of various solutions to be utilized for this purpose.

In 1790 a work of three volumes appeared on the history of impurities in the stomach and intestines by Frederick Hildebrandt,[108] a professor at Braunschweig. It treats of the method of cleansing the intestinal canal and calls attention to the value of enemas when their use is indicated. On the other hand, he refers to the poor results of this procedure when misused. He advises clysters of various forms for different conditions; warm water, decoctions of oatmeal gruel, of oil, of diluted vinegar, of salt and cold water, and occasionally of an infusion of tobacco. Hildebrandt advises the use of the piston syringe for this treatment and presents extremely clear and definite directions for the use of this procedure.

We have already referred to the early use of the enema in England. It is well to know that John Arderne,[30] the surgeon who flourished in the fourteenth century, employed this form of treatment with success.

James Primrose,[109] the son of a Scotchman, advocated the use of

[107] Wohts, D. Johann Jacob, *Abhandlung aller innerlichen und äusserlichen Krankheiten*, dritten auflage, Leipzig, 1753, pp. 138, 177, 574.

[108] Hildebrandt, G. Friedrich, *Geschichte der Unreinigkeiten im Magen und den Gedärmen*, Dritter Band, Braunschweig, 1790, Drittes Kapitel, S. 404-426.

[109] Primrose, James, *De Vulgi Erroribus in Medicina Libri IV*, Amsterdam,

clysters. Primrose had studied in Montpellier in France, settled in Hull and was elected to Fellowship in the College of Physicians in London. He was an active opponent of Harvey attempting to combat the latter's conception of the movements of the heart in his work on the popular errors of the people in physick, though he did not present any experimental evidence of his own to justify his contention.

In his chapter on the use of clysters Primrose states that many who maintain that the procedure is " perilous and dangerous are mistaken for clysters are the most gentle and innocent physick of all. Now a clyster is profitable for divers parts of the body for it doth not only loosen the belly but also by its liquid substances it doth deterge and cleanse tunicles of the bowels from many gross and vicious humours which cleave thereto and besides, it lies like a fomentation upon the kidneys and the bowels and therefore it oftentimes brings that out of the body which a reiterated purgation can never do." He advises a number of precautions in the employment of this procedure. He distinguishes between an enema injected through an oxen's bladder and by means of a syringe and concludes that the latter procedure can be utilized to greater advantage.

Burton,[110] in his " Anatomy of Melancholy," the first edition of which appeared in 1621, draws attention to the use of the clyster. He remarks, " taken into the inferior parts clysters strong or weak, suppositories of castilian soap, honey boiled to a consistence or stronger of scammony, hellebore, etc., these are all used and prescribed to this malady (to purge melancholy) upon several occasions." And again " sometimes clysters nourish as they may be prepared " and as correctors to expel wind, and against costiveness " put a pair of bellows end into a clyster pipe and applying it into the fundament open the bowels, so draw forth the wind. Nature abhors a vacuum and again many hypochondriacal melancholy men have been cured by the sole use of clysters."

1639, first edition; English edition: *Popular Errours or the Errours of the People in Physick*, trans. by Robert Wittie, London, 1651, Chapter XX, pp. 280, 281, 282, 283.

[110] Burton, Robert, *The Anatomy of Melancholy*, translation from the sixth edition (1651), New York, second partition, section 4, Member 2, subsec. 3; Second partition, section 5, Member 1, subsec. 4 and Member 3, subsec. 2.

About this time, the distinguished clinician Sydenham [111] makes many allusions to the use of the enema in his works. He remarks that in colic " when there are dry gripes without stools the bowels must be washed out by whey drunk cool and thrown up as a clyster warm." In cholera morbus, after advising a careful regulation of the diet he states; " he must use the same (a decoction) as a clyster as well. To these, the draughts and clyster, an ounce of the syrups of lettuce, violets, purslane, water lily or some similar adjunct may be added. In ileus, which supervened in the continued fever of the years 1661 to 1664, " purgatives taken by mouth are suddenly disgorged by vomiting and sharp clysters become emetics."

" In spring fevers blood may always be drawn and with young subjects, freely. Clysters and refrigerants too, are very useful in all cases when the patient is young, the fever obstinate and the previous venesection has not been over-frequent."

In Bates' " Dispensatory," [112] published in 1694, the formulas of various types of enemas to be used in the treatment of many affections are noted. The following statement appears: " You ought to have a short syringe much like an ear syringe but much less and the body of it all of a piece with the spout. Before using it, let the patient make water if he has occasion, and then exhibit the injection, injecting three syringes full at a dressing and after holding the end of the syringe in for about a minute before you suffer the water to come forth. This ought to be done at first five or six times a day; afterwards as the ulcer begins to heal, three to four times a day, and at last but twice a day till it is well and it ought to be continued for some time after it is seemingly perfectly well lest it should return again. If it be winter time and cold weather the injection ought to be made blood warm."

Arbuthnot,[113] the author of the history of John Bull, and the physician of Queene Anne, in commenting on inflammation of the

[111] Sydenham, Thomas, *The works of Thomas Sydenham*, trans. from the Latin edition of Dr. Greenhill by R. G. Latham, London [Sydenham Society], 1850, Vol. 2, pp. 265, 267, 269; Vol. I, pp. 67, 270.

[112] Bates *Dispensatory*, trans. from the second edition of the Latin copy, London, 1694, pp. 915, 918, 919.

[113] Arbuthnot, John, *An Essay concerning the nature of ailments and choice of them according to the different constitutions of human bodies*, 3rd ed., London, 1735, p. 357.

intestine notes " besides a copious bleeding, there is hardly any other method but fomenting and relaxing the bowels by emollient tepid liquids both taken by the mouth and by clysters injected hourly; yet it has been known by experience that acids have brought relief in very desperate cases since the juice of lemons taken by mouth and vinegar and water given in clysters have saved the patient from the effects of the incessant vomiting. If the vomiting happens to be in the lower guts, it can be reached by proper medicines in the form of clysters."

Thomas Coe [114] in 1757, in his treatise on biliary concretions, states: " clysters are another remedy which may be useful in the fit (colic) either to assist the operation of a purge or to procure stools when no purge has been given or can be retained in the stomach; and also as an internal fomentation to lubricate and relax the guts and by that means in some measure relieve the parts that are connected with or contiguous to them. The benefit of clysters is universally allowed in some form of colic; and doubtless they have a preferential use in the disorder we are treating of. In this case when they are used with a view to relax, they should be given in large quantities; and they are to be repeated as occasion requires. Common whey or water gruel with mallow roots boiled in it are liquors proper for this purpose; to which may be added a little oil."

In the work of William Cullen [115] we find the use of the clyster highly lauded. Cullen was an imposing teacher both in Edinburgh and Glasgow and his comments upon various therapeutic measures were authoritative not only in English but also in American medicine during the eighteenth century. He remarks, " the second set of remedies adopted to the cure of colic are purgatives. As the disease is often sealed in the great guts, and as clysters, by having a more sudden operation, may give more immediate relief and since purgatives given by the mouth are ready to be rejected by vomiting so it is common and indeed proper to attempt curing the colic in the first place by clysters. These may at first be of the mildest kind and consisting of a large bulk of water with some quantity of mild oil and

[114] Coe, Thomas, *A treatise on biliary concretions or stones in the gall bladder and ducts*, London, 1757, p. 278.

[115] Cullen, William, *First lines of the practice of physic*, Edinburgh, 1796, Vol. IV, pp. 29, 37.

such are sometimes sufficiently efficacious. However, they are not always so and it is commonly necessary to render them more powerfully stimulant by the addition of neutral salts of which the most powerful is the common or marine salt. Hardly any clysters are more effectual than those made of turpentine properly prepared. When all other injections are found ineffectual recourse is to be had to the injection of tobacco smoke." "The cases in which these large injections are most useful are those in which hardened feces are accumulated in the colon. The warm water answers two intentions namely dilating the passage and softening the faeces."

Fordyce,[116] a fellow of the Royal College of Physicians, and a reader of the Practice of Physic in London, advises the use of enemas for the constipation occurring in fevers and in inflammation of the intestines and recommends that the injections be "thrown in every two or three hours, till a stool is procured." Among many others who figured more or less prominently in England in advocating the use of the enema during the eighteenth century Kirkpatrick [117] and Clossy [118] may be mentioned. Numerous important contributions regarding the employment of the clyster were likewise presented during the nineteenth century; the first half was especially prolific in this respect.

In his lectures on diet and regimen Willich [119] advised clysters of cold water in cases of "debility and relaxation of the intestinal canal" causing constipation. He considered them of singular benefit. In his "Practice of Midwifery," in 1801, Denman [120] draws attention to the value of the enema in the treatment of "lingering and tedious labors occasioned by too much distention of the uterus." He advises the "repeated exhibition of emollient clysters" for this

[116] Fordyce, George, *Elements of the practice of physic*, London, sixth edition, 1791, pp. 168 and 255. Part 2, The history and methods of treating fevers and internal inflammations.

[117] Kirkpatrick, J., *Advice to the people in general with regard to their health*, London, 1766, p. 588.

[118] Clossy, Samuel, *Observations on some of the diseases of the parts of the human body*, London, 1763, p. 127; Sect. V, Case XIX, p. 118.

[119] Willich, A. F. M., *Lectures on diet and regimen*, London, 1800, third edition, p. 509.

[120] Denman, Thomas, *An introduction to the practice of midwifery*, London, 1801, Vol. 1, p. 272; Vol. 2, p. 9.

condition. In some cases in which the action of the uterus is very feeble and slow in its returns a clyster rendered stimulating by the addition of an ounce of culinary or carthartic salt will often rouse the dormant powers into action and the labor will be much sooner completed." He employed enemas composed of a decoction of linseed or of flour and water in pregnant women and when irritation of the rectum occurred clysters of opium.

Mackell,[121] a member of the Royal College of Surgeons, states that " by the frequent employment of cathartics the liver, the pancreas and the glands of the mucous membrane of the intestines are probably directly or indirectly, through the intervention of their excretory ducts, kept in a constant state of fretfulness." On this account, it is clear that enemas properly administered are desirable. He describes his apparatus which " will be found to embrace every requisite which can be desired in an instrument of this description.

Howship,[122] who was likewise a member of the Royal College of Surgeons, in calling attention to some of the most important diseases of the lower intestine and anus, favors repeated injections of warm water in inflammatory conditions of these parts since they will " essentially tend to the relief and comfort of the patient especially if assisted by the exhibition of gentle aperients."

In 1825 Read [123] demonstrated his special improved syringe for gastric lavage which was soon followed by the introduction of his clyster apparatus. He warned against fraud in the appearance of spurious instruments not of his manufacture and also with regard to the sale of his own apparatus at an excessive rate.

About the same time Weiss,[124] an instrument manufacturer, developed and patented a new type of pump for the following purposes: (1) for emptying the stomach of poisons; (2) for removing

[121] Mackell, T., " Practical remarks on the utility of enemas and on an improved method of administering them," *Medical and Physical Journal, London,* Vol. I, 1818, p. 198.

[122] Howship, John, *Practical observations on the symptoms, discrimination and treatment of some of the most important diseases of the lower intestine and anus,* London, 1824, third edition, p. 16.

[123] See Astley Cooper's address, *Lancet,* Vol. 1, 1823, p. 276 and *Lancet,* Vol. 7, 1825, p. 158; Read, John, *A description of Read's patent syringe or stomach pump and self injecting lavement apparatus,* London, 1829.

[124] Weiss, J., *Lancet,* Vol. 8, 1825, p. 191.

water in drowning before applying artificial respiration; (3) for giving enemata. This apparatus was widely used especially in Germany and many references are made to it both in German and French literature.

Fig. 17.

Read's Clyster.

[From John Read, *Read's Patent Syringe or Stomach Pump, Self Injection Clyster Apparatus*, London, 1829, p. 3]

From 1829 to 1834 Scott [188] produced four books of various sizes of from ninety to two hundred and seventy pages all commenting upon the usefulness of lavements. He especially recommended this treatment for habitual constipation decrying the pernicious effects of cathartics. A copious formulary of injections is mapped out by him with directions for their application.

[188] Scott, J., *Commentaries on the use and necessity of lavements in the correction of habitual constipation*, London, 1829; Idem, *Instructions in the use of lavements for preventing confinement of the bowels*, London, 1832, first edition; Idem, *Advice for the use of the lavements in preventing confinement of the bowels and removing various diseases*, second edition of above, London, 1833; Idem, *Indigestion unmasked; or, the pernicious effects of an habitual use of opening medicines, pointed out, and accompanied with advice for the removal of costiveness by the use of lavements*, London, 1834.

Alexander Monro [120] (1773-1859) the third, who like his father and grandfather held the professorship of Anatomy in the University of Edinburgh, in a description of intestinal concretions, com-

FLEXIBLE CLYSMA-DUCT.

Fig. 18.

[From Edward Jukes, *On indigestion and costiveness; on the important, safe and efficacious means of relieving diseases of the digestive organs by lavements*, London, 1831, p. 84]

ments that as early as May 1789 his father advised for the treatment of this affection a clyster of a quart of water in which an ounce of linseed and half of an ounce of castile soap had been infused for two hours.

[120] Monro, Alexander (Tertius), *Morbid Anatomy of the gullet, stomach and intestines*, Edinburgh and London, 1830, second edition, p. 50.

In 1831 a small volume published by Jukes [127] appeared on indigestion and costiveness in which the author recommended this method of treatment. "This disinclination" he states, "to employ a very beneficial and almost indispensable method of relief arose in some degree from the construction of apparatuses formerly used." He recommended his own instrument which he considers far more useful than others. He states that he has thus attained the principal object of the invention; namely, a perfect apparatus for the exhibition of lavements, complete in operation, admitting of the readiest adoption and easiest employment by the person requiring it. Jukes recommends his enema apparatus not only for the treatment of constipation but also for a variety of other purposes, for example, for the administration of antispasmodics, astringents, anthelmintics, anodynes, stimulants and nutrients in the bowel. His instruments are of two types; the one, his improved syringe, the other, the clysma duct consisting of a tapering funnel of water-proof composition and fitted to an ivory rectum pipe. The funnel is hung on a hook when filled; the ivory pipe is introduced, the fluid passing in the bowel by its own gravitation.

Jukes states that the distinguished Matthew Baillie,[128] the last to inherit the "Gold Headed Cane" is said to have advocated highly the use of the enema. "Injections do not appear in this country (England) so highly appreciated as they deserve, although on the continent their advantages are extensively acknowledged, and they constitute no trifling part of the practice of medical men. It is remarkable that they are not in more general use when we reflect how numerous are the complaints produced by a confined state of the bowels, and how quickly they are relieved by a removal of that cause. The occasional employment of injections is certainly the most convenient and comfortable way of obviating so frequent a source of misery and pain." "In a medical sense they are invaluable

[127] Jukes, Edward, *On indigestion and costiveness; on the important, safe and efficacious means of relieving diseases of the digestive organs by lavements*, London, 1831, pp. 2, 4, 79-85, 90-100.

[128] See Jukes, Edward, *loc. cit.*, p. 37. A thorough search for this quotation from Jukes' book was made by Dr. W. R. Bett and others among all of Baillie's works but without avail. Dr. Bett has suggested that the quotation may have been communicated in the form of a letter.

during the attack of inflammatory disorders and various other complaints to which the bowels are subject. When all other remedies prove quite ineffectual how often do we find a common injection of the most simple kind produce the most salutary results, and by unloading the lower bowels by clearing a passage for flatulent collections suspend the most distressing irritation and produce tranquility and rest."

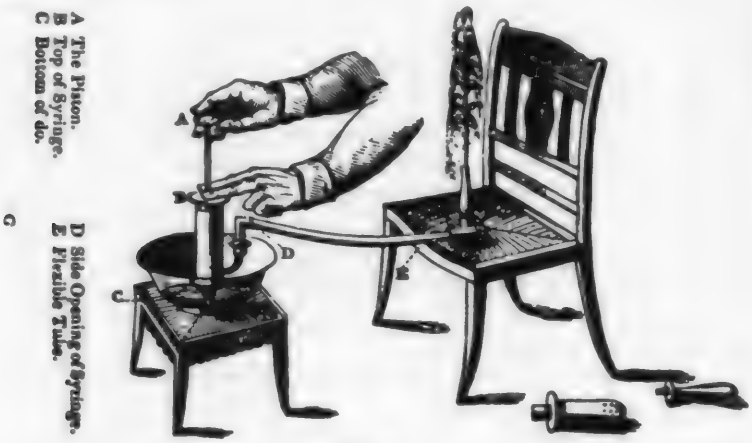


Fig. 19.

Jukes' Apparatus for Lavement.

[From Jukes, *op. cit.*, p. 81]

In 1831 Paty [129] recommended two new instruments for the treatment of obstructions of the large bowel. When, according to him, the contraction is at some distance from the anus, bougies will not answer the conditions and he therefore considers the instrument which he describes better adapted for this purpose than any hitherto employed. His instrument is called a hydraulic injector. The beneficial effect of this instrument is due to the flow of the injecting fluid by its own weight and pressure as the result of gravity from an elevated container. He likewise advises an olive ivory dilator for certain obstructions.

[129] Paty, James, "An account of two new instruments for the treatment of obstructions in the large intestine," *Lancet*, Vol. 2, 1831, p. 651.

In an interesting publication of O'Beirne [120] in 1834 the thought is expressed that a spasmodic contraction may occur in the lower bowel and colon which may be the cause of constipation. If this spasmodic stricture be of long standing, he states, and should it occur in an individual in whom age and natural predisposition lead to such a tendency, it will ultimately degenerate into and become of a scirrhous and malignant nature. The principal means of relief, he maintained, is the employment of a bougie. A hollow gum elastic bougie of large size is introduced as high up as the sigmoid flexure and is very efficacious by dilating and relieving the spasm if used sufficiently often. Following the expulsion of flatus through the tube a flow of feces may escape and after applying the properly adjusted syringe to the tube the necessary laxative fluid is injected. At first O'Beirne used a gum elastic catheter to dilate and then finally the tube of a stomach pump was found more effective. By means of a modification of the Weiss syringe which he had manufactured O'Beirne found that " fluid can be easily introduced into the bowel which is usually followed by a copious discharge of stool." He calls attention to the fact that he had " employed this mode of treatment for more than nine years with the most decided (unexampled) success on almost every variety of disease attended with constipation."

Inasmuch as O'Beirne's publication appeared in 1834, it is evident that the bougie must have already been employed as early as 1825 for dilatation and for the relief of spasm of the lower bowel and that he must have been an early advocate of the procedure for these purposes. O'Beirne likewise advised the introduction and retention of the gum elastic tube in the bowel for the relief of gaseous distention.

He utilized various forms of enemas, the most important of which were (1) warm water, castor oil, olive oil, oil of turpentine and sulphate of soda; (2) warm water, tincture of asafoetida, olive oil, sulphate of magnesia, oil of turpentine; (3) a pint of warm water in which a half drachm of tobacco has been infused. O'Beirne considered this tube as one of the great improvements in modern surgery. He deserves great credit for popularizing the rectal tube

[120] O'Beirne, James, *New views of the process of defecation and their application to the pathology and treatment of diseases of the stomach, bowels and other organs*, Washington, 1834, pp. 22, 25, 34, 38, 39, 61, 65, 51, 45, 70, 73.

and bougie as a method for dilating the rectum and relieving spasm and for aiding the expulsion of gas.

William Prout,[181] who proved that the acid of the gastric secretion is free hydrochloric acid, states that alleviation from the pain produced by renal concretions is also obtained at times by the simple injection of warm water into the bowels. This procedure may be used at first with the view of clearing the bowels; afterwards, it may be repeated if necessary with the addition of sedatives.

Another English physician, Marshall Hall[182] (1790-1857) who was known as an expounder of physical experimentation favored the use of enemas in two of his works (1820 and 1845). Among other remarks, he says that no means of relieving the intestine is so ready or so simple as the injection of mere water. This procedure may with great propriety indeed, be denominated the " washer " and so it is, both in the ancient Greek and modern term clyster (from to wash) and lavement, which have this precise meaning respectively. He favors the employment of the Read's syringe for this purpose and gives detailed directions for the use of the enema under various conditions.

Alfred Hall,[183] a member of the Royal College of Surgeons of England, was likewise impressed with the efficacy of large enemas in certain types of severe constipation. He reported to the Medical Clinical Society of Glasgow Oct. 28, 1845, that he had engaged in a series of experiments to determine the height to which fluids could be injected into the bowel. He utilized the Read's enema syringe, injecting five to six pints of thin gruel for this purpose. Six experiments were performed, three upon living human subjects and three upon the dead. In the post mortem subjects, following the injections, the abdominal wall was cut through and the large intestine was found

[181] Prout, William, *On the nature and treatment of stomach and renal diseases,* London, 1840, third edition, p. 338.

[182] Hall, Marshall, *A descriptive, diagnostic and practical essay on disorders of the digestive organs and general health,* London, 1820, second edition, pp. 75, 100; also *Practical observations and suggestions in medicine,* London, 1845, chapter 13, p. 70.

[183] Hall, Alfred, " On the efficacy of large purgative clysters in certain forms of obstinate constipation of the bowels," *The Monthly Journal of Medical Science,* Vol. 61, 1846 (Jan.), Part I, p. 1.

full of the fluid which was used, it having extended beyond the ileocecal valve. Enemas were similarly injected into living objects, percussion being carefully performed over the large bowel before and following this procedure and the fluid was observed to have passed the transverse colon. He also demonstrated that three pints of fluid were sufficient to distend the entire large bowel of a full sized man.

Hall desired it be clearly understood that he was by no means advancing or advocating any new views in medicine since the procedure recommended by him had been used in the fourth century as is indicated in the works of Oribasius. He disagreed with Drs. Christison, Burns and Thomson who recommended small quantities (one pint). On the other hand, Graves and Marshall and others about this time advised large enemas. Alfred Hall differed, however, from Marshall Hall regarding the character of the fluid to be employed. The former recommended well boiled oatmeal gruel with a mixture of salt and butter. Alfred Hall concluded his remarks with the statement that to obtain full benefit he must insist " that the procedure be undertaken by the medical attendant himself and in the slow prolonged way which he has recommended (the guard of the clyster pipe being pressed firmly against the anus to prevent regurgitation), bearing in mind that it should precede other remedies rather than follow them and recollecting also that costiveness has its seat nearly as often in the colon as in the rectum but that clysters, properly given, prove as efficacious in one case as in the other."

The names of numerous other English physicians, of more or less prominence, who advised the employment of the enema may be found in the literature of the first half of the nineteenth century. Among these is Andrew Combe, Herbert Mayo, James Johnson and Robert Christison. Combe,[184] a Fellow of the Royal College of Physicians of Edinburgh, states: " It sometimes happens that when food or medicine cannot be swallowed in the usual way, life is preserved by injecting it into the bowels."

Mayo,[185] a senior surgeon of the Middlesex Hospital, advises an

[184] Combe, Andrew, *The physiology of digestion with relation to the principles of dietetics*, Edinburgh and London, 1836, second edition, p. 164.

[185] Mayo, Herbert, *Management of the organs of digestion in health and disease*, London, 1837, pp. 102 and 103.

enema of a pint of cold water since in his belief it is more stimulating when the bowels are constipated as the result of sluggishness of the muscular structure of the bowels. Occasionally, however, it is better to use warm water.

Johnson,[136] of the Royal College of Physicians and physician to the Duke of Clarence, recommends enemas as auxiliaries to the use of aperients. "In high grades of gastric and intestinal irritability it is hardly possible to give an aperient by mouth, even castor oil without producing disagreeable effects; here, the employment of injections is of great advantage."

Christison,[137] Professor of Materia Medica in the University of Edinburgh, in his work "Dispensatory or Commentary on the Pharmacopoeias of Great Britain" states that the "administration of drugs in the form of injections is often neglected. The quantity of fluid to be used should not be less than sixteen ounces or a pint to evacuate the bowel but if the fluid is to be absorbed it should not be administered in a quantity exceeding four ounces. Otherwise, it is speedily ejected." He describes the use of asafoetida, tobacco, turpentine and other forms of enemas.

Toward the middle of the nineteenth century following the enthusiastic work of Priessnitz [138] the water treatment was heralded, often as a cure all, for many affections. Priessnitz, who resided in Graefenberg in the Austrian Silesia, saw his fame spread near and far, although by many he was regarded as a quack. His treatise was translated into various languages and many physicians enthusiastically followed his method of treatment to a greater or lesser degree. While the water treatment actually originated in the remote ages and was practiced to a certain extent during all the centuries Priessnitz deserves the credit for having developed and systematized it as a form of therapy. Priessnitz advised the use of enemas of water for the treatment of affections of the bowel. These were to be given cold and were, according to him, valuable both for the treatment of constipation as well as for diarrhea. "These diseases are opposites, but

[136] Johnson, James, *An essay on indigestion*, London, 1829, sixth edition, p. 91.

[137] Christison, Robert, *Dispensatory or Commentary on the Pharmacopoeias of Great Britain*, Edinburgh and London, 1842, pp. vii, 189, 193, 662, 903, 912.

[138] Priessnitz, Vincent, *The cold water cure: its principles, theory and practice*, London, 1842, pp. 27, 36, 38.

both proceed from the same cause, weakness of the intestine, which is remedied by giving tone to the organs and regulating their function." This is facilitated by means of cold water clysters. At first they should not be given for more than two minutes but after the patient becomes accustomed to them " the clyster will be frequently absorbed like a glass of water in the stomach." A second clyster should follow the first. Special syringes are to be utilized for this purpose.

Among the various types of enemas frequently employed during the seventeenth, eighteenth, and early nineteenth ecnturies was a clyster consisting of the fumes of tobacco. A special apparatus was utilized for its preparation and rectal introduction in either a cold or hot state. The apparatus consisted of a closed metallic container in which the tobacco was burnt and the fumes were propelled by means of bellows which were attached to the enema tube. Even at an earlier period it is known that fumes were frequently forced through the tube by means of oral respiratory pressure. This treatment was administered in cases of intestinal obstruction, intractable constipation, intestinal colic, strangulated hernia and in the resuscitation of individuals apparently drowned. Tobacco was also administered rectally in the form of an infusion (2 to 4 grams to 500 cc. of water).

Tobacco injections were recommended by de Graaf [40] (utilizing the fumes), by Cullen,[115] Sydenham,[111] O'Beirne,[180] Jukes and many others. On the other hand, Colson [46] pointed out in 1867 that while this type of treatment has not been entirely discarded it was to be considered more dangerous than useful and Jukes stated as early as 1831 that there was considerable danger attending its administration. It was finally abandoned as a therapeutic measure.

The enema was well known in early American history. The medicine man of the American Indian utilized this procedure in his treatment. In Patagonia,[189] a bladder was employed for this purpose. The Aztecs of Central American considered general listlessness and pains all over the body due to bowel disturbance and the usual treatment given the patient was an enema.

[189] Corlett, William Thomas, *The medicine man of the American Indian and his cultural background*, Baltimore, 1935, pp. 242, 174, 183, 301.

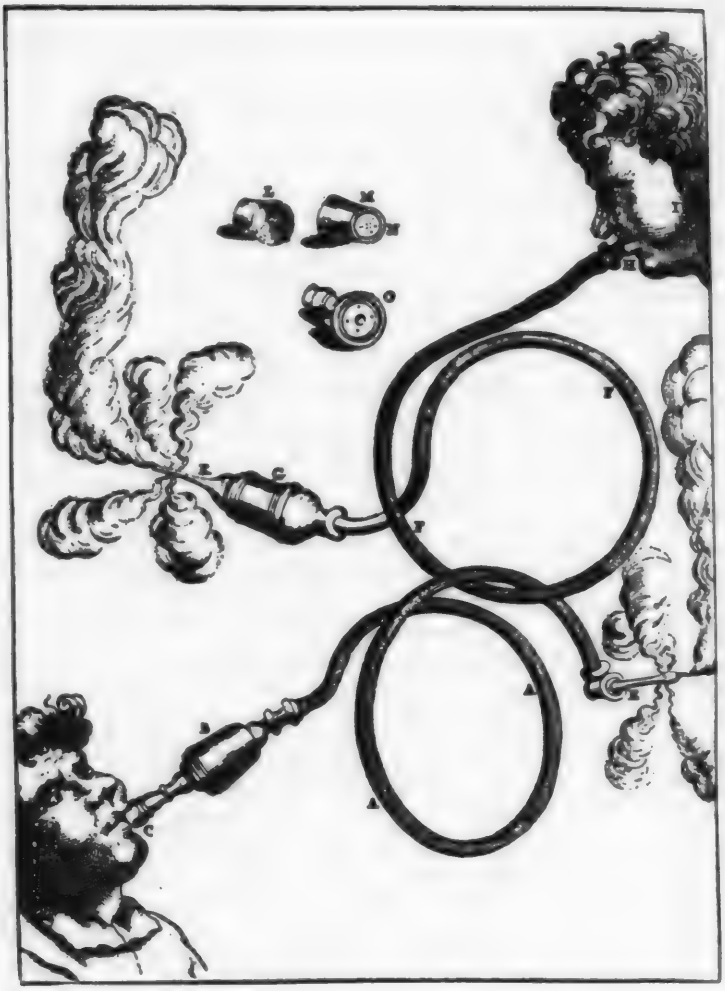


Fig. 20.

Lavement de fumée de tabac contre le volvulus.

[From P. Desfosses et A. Martinet, "Le Lavement," *La Presse Médicale*, 1903, Vol. 1, p. 311]

Among the Mayas in Central America, prior to the Spanish conquest, boys suffering with gas were relieved by enemas. It is not known, according to Corlett,[139] whether use was made of the rubber clyster but he considers this possible.

The rubber clyster was utilized in South America and among the Mexicans; intoxicants were injected rectally into those taking part in certain religious ceremonies. According to Russell,[2] Baron Nordenskiöld likewise reports that enema syringes made of india rubber were used at an early period by the South American Indians. These syringes consisted of a rubber bag connected with a conical nozzle. Baron Nordenskiöld [140] credits the discovery of rubber and its utilization in the manufacture of rubber balls, enema syringes, etc. to the Indians. According to this explorer in pre-Columbian times, the Indians were acquainted with all the qualities that make rubber important in our modern life. Before the discovery of America no corresponding discovery had ever been evolved in the old world, notwithstanding the fact that rubber trees of various types were known to flourish both in Asia and Africa.

He made a special study of the enema syringe in South America and he was able to prove it to be purely an Indian invention. There were two forms of enema apparatus, the enema tube and enema syringe, the latter being an improvement on the former. As regards the rubber syringe it is an invention which was preceded by the hollow rubber ball. It is interesting to note that the Indians utilized parica as an intoxicating enema.

Corlett [139] remarks that among the North American Indians " the long bones of various animals are often used as suction tubes and for forming the nozzles of syringes, the receptacle or bag of the apparatus being made of the bladder of some animal. Most medicine men acquire strength in the muscles of the mouth sufficient to eject fluid with greater force than by a syringe. This was the favorite method in most tribes of cleansing foul ulcers."

Sigerist [141] tells of the use of the enema (as well as cathartics) among the ancient Indians as a means of opening the bowels.

[140] Nordenskiöld, Erland, " The American Indian as an Inventor," *Journal of the Royal Anthropological Institute of Great Britain and Ireland*, Vol. 59. 1929, pp. 290 and 279.

[141] Sigerist, Henry E., *American Medicine*, Norton and Company, New York, 1934, p. 9.

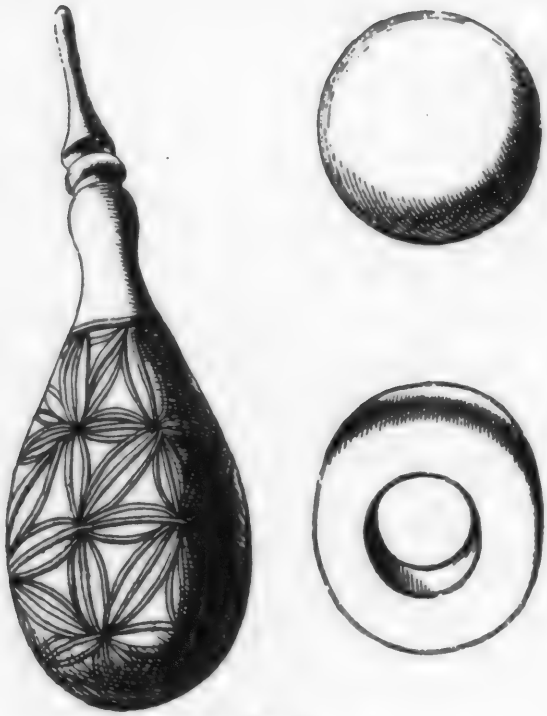


Fig. 21.

Enema Syringe, Rubber Ball, and Elastic Ring from the Indians of Guiana and the Amazon Region. (After Barrere.)

[From Erland Nordenskiöld, "The American Indian as an Inventor," *Journal of the Anthropological Institute of Great Britain and Ireland,* Vol. 59, 1929, p. 278]

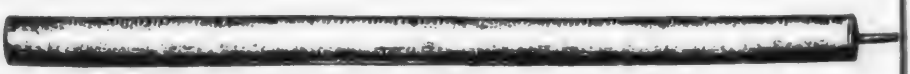


Fig. 22.

Enema Tube, from the Chocó Indians, Colombia.

[From Erland Nordenskiöld, *op. cit.*, p. 290]

Among the Missouri River group of Indians and a few scattered tribes, according to Stone [143] enemas given by means of a syringe, were used. The apparatus consisted of an animal bladder to which a nozzle of the hollow cylindrical leg bone of a chicken or turkey was attached. Water was usually employed, although the Dakotas mixed with it pulverized bark from the root of the Kentucky coffee trees.

In this country during the late eighteenth and early nineteenth centuries, the medical literature contains numerous references to the use of the enemas; however, little new was added either as to technical improvements in the apparatus or in its application. Moreover, physicians were perfectly familiar with its use through the literature which reached this country from abroad.

In his account of bilious remitting yellow fever as it appeared in Philadelphia in 1793 Benjamin Rush [144] writes that " following the observations of Dr. Stevens laxatives are never employed except when clysters are not attended with the desired effect of moving the bowel; in violent attacks of disease the bark clysters are repeated every two hours." Furthermore, he observes that when purges were rejected or were slow in their operation " opening clysters " were ordered to be given every two hours. He also found that cold water applied to the external parts of the body and injected into the bowel by way of clysters did valuable service in many instances.

John Hahn,[144] in an inaugural dissertation submitted to the University of Pennsylvania in 1798 for the degree of Doctor of Medicine, attempts to offer proof of the absorptive power of the colon and the advantage to be derived from nutritive enemata.

In 1831 Peirce [145] advised the use of warm water injections and described an apparatus for their administration. He was impressed with the fact that they were less harmful than cathartics and while

[143] Stone, Eric, *Medicine among the American Indians,* Paul B. Hoeber, New York, 1932, p. 39.

[144] Rush, Benjamin, *An account of the bilious remitting yellow fever as it appeared in Philadelphia in the year 1793,* second edition, 1794, pp. 21, 247, 91.

[144] Hahn, John, *Observations and experiments on the use of enemata and the external application of medicines to the human body,* Thesis, Philadelphia, 1798.

[145] Peirce, Leonard, " Remarks on the use of injections of warm water with a description of an apparatus for their administration," *Boston Med. and Surg. Journal,* Vol. 4, 1831, p. 284.

the most immediate effect produced was vomiting, that could be prevented by introducing the enema slowly. He employed injections (one to four quarts) in cases of colic, convulsions and constipation. Injections of cold water were recommended as useful in stages of bowel inflammation. In severer cases flaxseed tea was advised.

Cock and Paige,[146] in the same year, discussed the efficacy of large injections in the treatment of bilious colic and in a review of Howship's [147] book on "Stricture of the Colon" the use of warm fluid injections given slowly at a temperature of 96° F., was recommended for spasmodic stricture.

In his treatise on the "Practice of Medicine" Eberle,[148] Professor of Materia Medica in the Ohio Medical College and a member of the American Philosophical Society, states in his treatment of chronic constipation (1831) that "the operation of cathartics may be greatly aided by the administration of an enema. Injections are indeed an important remedy in this disease and have in this country and England been too much neglected. They should be simple emollient and frequently repeated." He also advises enemas to be given at short intervals in cases of flatulent colic until the bowels are frequently moved.

In an editorial [149] in the *Boston Medical and Surgical Journal* of May 1831, an improved enema apparatus invented by Mr. Maw is described, which may be adjusted for self administration; it is portable and little liable to become out of order.

James Thacher,[150] in 1826, advised clysters of oil in costiveness attended with pain in relaxed individuals and especially when associated with impacted feces. He likewise recommended the "sedative powers" of enemas containing the fumes or mild infusions of tobacco.

In a manual of directions for the employment of injections by

[146] Cock, Thomas and Paige, J. S., "On the efficacy of large injections in the treatment of bilious colic," *Boston Med. and Surgical Journal*, Vol. 4, 1831, p. 350.

[147] Howship, John, "Stricture of the colon," *Boston Med. and Surg. Journal*, Vol. 4, 1831, p. 150.

[148] Eberle, John, *Treatment in the practice of medicine*, Philadelphia, 1831, second edition, Vol. 2, pp. 323 and 343.

[149] Editorial in *The Boston Medical and Surgical Journal*, Vol. 4, 1831 (May 3), p. 197.

[150] Thacher, James, *American Modern Practice*, Boston, 1826, pp. 504, 592.

Mattson [151] in 1857 in which his syringe is recommended by John C. Warren, Professor of Anatomy and Surgery at Harvard, a description of the use and value of injections is given. He describes the superiority of his special piston or plunger syringe. Mattson defines the quantity of fluid required for injections, the temperature and directions for administering enemas and describes various fluids to be used in the procedure.

Professor Dewees [152] is quoted on the title page with the following remark: " For the good of the afflicted we hope that enemas will be looked upon as indispensable medical as well as domestic remedies."

The following statement of Dewees [152] is an indication of how the enema was regarded in this country about the middle of the nineteenth century. In his practice of medicine this author states, " the value of enemas is only beginning to be appreciated in the United States. They have had to contend against much prejudice to gain their present consideration. An injurious and fastidious delicacy has prevented their general employment especially outside of our cities; and it is only within a few years, even in our cities, that they have been looked upon as prompt and efficient remedial applications. For the good of the afflicted, we hope this prejudice will soon wear away, and that they will be looked upon as indispensable medical as well as domestic remedies."

Dunglison,[153] in his " General Therapeutics," noted that injections are indeed most valuable agents and until late have been little employed in this country but on the continent of Europe they form a part of the boudoir of every female and are regarded as indispensable to cleanliness and to health. He advised the use of cold and also of hot water enemas which he believes act favorably not only locally at their seat of contact but equally as well in parts higher up. He recommended salt water or molasses and water or gruel with salt

[151] Mattson, M., *Manual of directions for the employment of injections in various diseases with remarks upon the nature and treatment of habitual constipation,* Boston, 1857, second edition, p. 65 ff.

[152] Dewees, William P., *A practice of physic,* Philadelphia, 1833, Chapter 14, p. 52, General observations of administering injections.

[153] Dunglison, Robley, *General therapeutics or principles of medical practice,* Philadelphia, 1836, section 6, p. 245.

and castor oil as enemas. At times when the constipation is the effect of spasm, clysters of tobacco given in the form of infusions or of smoke, were administered by him.

The eminent surgeon John C. Warren,[154] already referred to, who has had the distinction of having introduced ether anaesthesia in surgery states in a publication in 1850 on the prevention of constipation, " It would not appear proper to pass over injections so generally employed abroad and so little in this country. Their application is to be preferred when it answers in the place of any cathartic. For the relief of the bowels, the prevention and cure of hemorrhoids and the mitigation of urinary and uterine derangements cold water in quantity from a gill to a quart is most valuable."

Following the heralding of the cold water treatment of Vincent Priessnitz, Joel Shew,[155] in a short treatise written in 1847, recommended injections and clysters of pure water in the place of cathartics whenever possible, since they assisted the bowels. These were to be administered every other day at first of tepid and then of cold water. He stated that quart after quart of lukewarm water may be used until the bowel is completely emptied.

The history of the enema would not be complete without a word about certain related procedures and instruments which more or less grew out of the enema background or at least are connected with it in historical development. Some of these are the speculum, the endoscope, the proctoscope, the sigmoidoscope and the bougie in the field of instruments and on the other hand, colonic irrigations, nutrient enemata, Murphy drip, rectal anaesthesia and rectal medication in the realm of therapeutic procedures. But first a few words regarding dangers and accidents due to the enema and on that curious occurrence—eruptions from enemas—mentioned periodically in the literature.

1. *Dangers, Accidents, Eruptions.*

Attention has already been directed to the occurrence of fatalities in connection with the use of enemas. Such reports had appeared in the beginning of the nineteenth century and since that time many

[154] Warren, John Collins, " On the prevention of constipation," *Am. J. Med. Science*, New Series, Vol. 19, 1850 (April), p. 294.

[155] Shew, Joel, *Water Cure*, Coopertown, N. Y. (H. E. Phumer), 1847, p. 92.

individuals have recorded a variety of serious results, not excluding death, in association with enema administration. One of the recent reports is that of Curtin [156] who, in 1902, recorded a case in which a patient suffering with chronic constipation took an enema to relieve abdominal pain and as a result developed an acute febrile abdominal emergency which at autopsy, 24 hours later, was found to be a perforated sigmoid with peritonitis. It was believed that either the nozzle of the enema tube or the force of the enema stream was sufficient to have perforated an old sigmoid ulceration.

Even more recently in 1937, Pinnock [157] reported two instances of rectal trauma due to a rigid nozzle. In one case the rectal wall was penetrated and perirectal and sub-peritoneal spaces were injected with a large amount of non-sterile liquid. In the second case the mucous membrane was stripped up. Pinnock emphasized the danger of allowing nurses to introduce solid nozzles into the rectum. Moreover, it has been common knowledge for years that utmost care is to be taken in any colonic procedure performed in the presence of ulcer or diverticulum. Similar reports, and many more of a less serious nature, are scattered through the literature. Some of them, however, are not complete enough to be convincing.

It is interesting also to consider the record of eruptions in association with enemas which in the older literature were reported much more frequently than now. Again there is room for honest doubt as to cause and effect. As an example of the appearance of an erythematous rash following an enema is the report of Crawfurd [158] who describes scarlatinal and urticarial rashes as not uncommon after enemata; likewise, Hale [159] calls attention to a similar occurrence after the administration of nutrient enemas. The explanation of these eruptions is said to be due to the " sudden absorption into the blood and lymph streams of poisons from feces accumulated in the intestine." Crawfurd stresses the recognition of these cases so as to avoid confusing them with cases of scarlet fever. In Hale's case

[156] Curtin, T. H., " Death Following an Enema," *Med. Rec.*, Vol. 61, 1902, p. 613.
[157] Pinnock, D. D., " Dangerous Rectal Trauma Due to Rigid Nozzle," *Lancet*, vol. 1, 1937, p. 205.
[158] Crawfurd, G. R., " Erythematous Rashes Following Enemata," *Therap. Gazette*, Vol. 14, 1898, p. 660.
[159] Hale, G. E., " Scarlet Rash After Enemata," *British M. J.*, Vol. 1, 1895, p. 474.

the rash disappeared quickly even though the enemata were continued. This was explained by the belief that the rash was due to absorption of fecal matter softened by the enema because it did not recur when fluid was injected into the bowel after it was emptied of feces. Whether this conception is acceptable is a matter of debate. The fact remains that prior to these accounts and many times since, up to the very present, reports of this relationship have appeared especially from those who devote a great deal of their time to colonic lavage and related procedures. The eruptions being usually of the urticarial type make one wonder whether allergy plays a rôle in the mechanism and in fact, this has been suggested.

2. *Speculum.*

As early as the fifth century A. D. the Hindu surgeon Sushruta [26] had described a rectal speculum along with rectal bougies. In one of his books on the history of medicine Singer [160] describes a speculum recovered from Pompeii. Reference to the speculum is found in some of the earliest text-books although the first special text-book on diseases of the rectum, " Practical Treatise on Stricture of the Rectum " written by Frederick Salmon [161] and published in London in 1828 did not raise it to the dignified place which it received in a later book on " Diseases of the Rectum," by T. J. Ashton,[162] the 2nd edition of which appeared in 1857, and which specifically states that " in some morbid conditions of the rectum great advantage is derived by the use of the speculum for the purpose of examination and also in performing operations." Since rectal diseases, according to Allingham,[163] are among the most common which affect the civilized community it is logical to conclude that the speculum would be invented and improved with alacrity. Originally, the introduction of such instruments were painful but with their development into the round forms that disadvantage disappeared. The speculum was

[160] Singer, Chas., *A Short History of Medicine*, Oxford, 1928, p. 44.

[161] Salmon, Frederick, *Practical Treatise on Stricture of the Rectum*, London, 1828.

[162] Ashton, T. J., *Diseases of the Rectum*, 2nd edition, London, John Churchill, 1857.

[163] Allingham, W., *Fistula, Haemorrhoids, Painful Ulcer, Stricture, Prolapsus and other Diseases of the Rectum; their Diagnosis and Treatment*, Philadelphia, 1882.

found to be especially useful in connection with the non-operative treatment of internal hemorrhoids, the removal of hypertrophied anal papillae as well as for exploring the crypts of Morgagni for disease or foreign bodies, and in making applications to ulcers of the anal canal.[164] Most specula were made before the introduction of the proctoscope. The excellent modifications of the round tubes of Kelly and others followed later. Historically, therefore, the first instrument in making a rectal examination was the speculum. It was not very helpful and moreover, had as its chief fault the fact that after its introduction its presence obscured the bowel. This is primarily what led to the more perfected methods of examining the lower bowel.

3. *The Endoscope.*

The endoscope followed the speculum. Among a number of reports upon its application that of Cruise [165] in 1865 clearly explained its practical utility in the diagnosis and treatment of hitherto obscure forms of disease especially in regard to the rectum. He pointed out how it enabled the practitioner to obtain a satisfactory view of deep cavities (such as the bladder and rectum) which heretofore had been generally regarded as quite inaccessible to direct vision. The development of the endoscope naturally led directly to the introduction of the proctoscope and sigmoidoscope.

4. *The Proctoscope and Sigmoidoscope.*

In his clinical handbook " The Sigmoidoscope—A Clinical Handbook on the Examination of the Rectum and Pelvic Colon " published in 1906, Lockhart-Mummery [166] pointed out the indications, limitations and method of use of the sigmoidoscope. This apparatus had become a necessary adjunct in diagnosis in disease of those portions of the sigmoid and rectum which are otherwise inaccessible. He reminds us that the use of the tubular speculum for examining the rectum is of comparatively recent date. Another historical event

[164] Hill, T. C., *A Manual of Proctology,* Lea & Febiger, Philadelphia and New York, 1923.

[165] Cruise, Francis, " The Endoscope," *Lancet,* Vol. 1, 1865, p. 327.

[166] Lockhart-Mummery, P., *The Sigmoidoscope—A Clinical Handbook on the Examination of the Rectum & Pelvic Colon,* London, 1906.

was the invention by Bodenhamer [167] in 1863 of a long tubular speculum which was partly flexible. However, it was not very efficient as a diagnostic measure but the name [168] of its inventor ranks high in the historical development of our knowledge of rectal disease.

All the earlier instruments were used with the patient lying on his side and only that portion of the bowel wall which was in direct contact with the end of the speculum or tube could be viewed. It is difficult to state to whom credit is due of first employing the genu pectoral position and thus taking advantage of atmospheric distention as an aid in the diagnosis of rectal disease. However, it was Marion Sims who demonstrated the advantage of utilizing atmospheric pressure in examination of the vagina in 1845. Moreover, Allingham invented one of the early instruments for examining in this position and Kelly of Baltimore did much to advance this method. With the invention of the electric sigmoidoscope the diagnosis of lesions in the upper part of the rectum and in the sigmoid flexure of the colon improved. This marked as great an advance as the laryngoscope in the diagnosis of lesions of the larynx or the cystoscope in bladder lesions and finally, the electric pneumatic sigmoidoscope also represents a great advance in our powers of accurate diagnosis in this field.

Many interesting historical notes on rectoscopy and sigmoidoscopy can be found in the book by Bensaude [169] entitled " Traité D'Endoscopie Recto-Colique." Hill [164] has also pointed out the great progress from the early electric, head mirror, stationary light proctosigmoidoscope to the later more direct type with the electric lamp at the distal end of the tube. Extremely helpful in tracing progress in this field are the writings of Bodenhamer [167, 168] and Wright.[170] The recent monograph by Buie [171] on " Proctoscopic Examination and

[167] Bodenhamer, Wm., *The Physical Exploration of the Rectum*, New York, Wm. Wood and Co., 1870.

[168] Bodenhamer, Wm., *A Practical Treatise in the Aetiology, Pathology and Treatment of the Congenital Malformations of the Rectum*, New York, Samuel S. & Wm. Wood, 1860.

[169] Bensaude, Le Dr., *Traité D'Endoscopie Recto-Colique. Rectoscopie. Sigmoïdoscopie.* Masson et Cie Editeurs, 1919, Paris.

[170] Wright, J. W., *Lectures on Diseases of the Rectum*, New York, Bermingham & Co., 1884.

[171] Buie, L. A., Mayo Clinic Monographs. *Proctoscopic Examination and the*

the Treatment of Hemorrhoids and Anal Pruritis" devotes its second chapter to the equipment for proctoscopy. It is of fundamental importance to those interested in this field historically or otherwise.

5. *Colonic Irrigations.*

Although Russell [2] and others [172] trace the use of colonic irrigation in its cruder forms to early times, the form of colonic irrigation which today is part of what has been termed physical medicine is evidently a distinctly modern procedure. In a strict sense the idea of intestinal irrigation was identified as a procedure distinct from the usual enema treatment toward the latter part of the nineteenth century, notwithstanding the knowledge of it before that period. Such works as Russell's book on "Colonic Irrigation" and Wiltsie's [173] on "Chronic Intestinal Toxemia and its Treatment" present the modern point of those who advocate colonic irrigation as a therapeutic measure. In a communication entitled "Value, Indications, Limitations and Technic of Colonic Irrigation" [172] we have attempted to appraise the procedure without prejudice. For a comprehensive review of the newer colonic lavage apparatus and its appreciation as well as some interesting historical notes, reference should be made to Russell's book.

6. *Nutrient Enemata.*

Celsus probably first called attention to the use of nutrient enemata although, as has already been pointed out, credit has been accorded to others. In more recent times increasing interest has centered around the subject of nutrient enemata and their value. De Graaf also wrote interestingly and significantly regarding nutrient enemata and published a thesis on the subject in 1798. Space is not available for a review of these interesting points of view.

However, in 1907, Moore [174] wrote a splendid review on the sub-

Treatment of Hemorrhoids & Anal Pruritis. W. B. Saunders & Co., 1931, Philadelphia and London. Equipment for Proctoscopy, Chapter II.

[172] Friedenwald, J. and Morrison, S., "Value, Indications, Limitations and Technic of Colonic Irrigation," *Med. Clin. of N. A.*, May, 1935.

[173] Wiltsie, J. W., *Chronic Intestinal Toxemia and Its Treatment*, Wm. Wood & Co., Baltimore, 1938.

[174] Moore, F. C., "Rectal Feeding.—A Review," *Practitioner*, Vol. 79, 1907, p. 668.

ject of rectal feeding. Since, under certain conditions, it may be imperative that administration of food by mouth should be suspended and since rectal feeding was considered more feasible than subcutaneous or intraserous methods, Moore proceeded to investigate the value of rectal feeding. In his studies the bowel was always previously cleansed. He concluded that it is possible by rectal feeding to introduce a certain amount of food into the organism, but that even accepting the more favorable results of recent investigations the conclusion was inevitable that rectal feeding amounts at best to a pronounced subnutrition, that only in exceptional cases, in which the metabolic processes have been gradually reduced to an abnormally low level, is it possible to provide an amount of protein as will establish nitrogenous equilibrium.

In the average case rectal feeding is associated with progressive loss of weight and cannot be relied upon. He pointed out that alcohol is a frequent constituent of nutrient enemata, that it is well absorbed in solution of 0.5% to 2% and by some it was held to facilitate the absorption of such substances as glucose and proteids. He concludes that in recognition of the present limitations of the method it would appear that the best results are to be obtained by the use of enemata composed of predigested proteids, of albumoses, or peptones, the two latter in 10% concentration, of emulsified fat, in the form of yolk of egg, and of glucose in 10% concentration, with the addition of sodium chloride to 1%.

Among some of the earlier publications is that of Dana [175] (1883) who discussed the physiological process of absorption of nutrient enemata as shown by experiments on absorption in dogs. Cutter [176] (1815) found enemata of white eggs efficacious. On the other hand, Maxwell [177] (1873) doubted the efficacy of nutritive enemata because, in his opinion, food had to be digested before it could be absorbed. Aside from this debate, however, is the general acceptance of normal salt solution enemata and their value in many instances.

[175] Dana, C. L., "The Absorption of Nutrient Enemata," *Med. Rec.*, Vol. 23, 1883, p. 6.

[176] Cutter, J. A., "Enemata of White of Eggs," *J. A. M. A.*, Vol. 25, 1895, p. 147.

[177] Maxwell, C. T., "Can 'Nutritious Enemata' be Digested & Assimilated," *Med. Times*, Vol. IV, 1873-74, p. 434.

Furthermore, proctoclysis has been especially useful for the introduction of fluids which would not be tolerated by the stomach and one of these is salt solution. Another is glucose which, as pointed out by Lasch,[178] in 1922, in discussing the value of nutrient enemata, is definitely, though only partly, absorbed.

In 1934 Soper [179] discussed the enema and colonic lavage. In his estimation the introduction of ordinary foodstuffs per rectum has been practically abandoned because of the failure of the colon to absorb and utilize them. Water, weak solutions of alcohol, normal saline solution, and 3% solutions of glucose are readily absorbed and utilized. He recommended the Murphy drip method but in some patients with sensitive anal canal reflexes he found it preferable to slowly introduce about 4 ounces of the fluid every three hours.

7. *The Murphy Drip.*

The Murphy Drip was originally described by J. B. Murphy [180] in 1908. A description of the apparatus as used by him can be found in his " Surgical Clinics." Others have discussed this procedure and have urged its use.

8. *Rectal Anesthesia.*

In his book on " The Art of Anaesthesia " Flagg [181] discusses rectal anesthesia. He observes a fact we now all know, that it is possible to induce and maintain anesthesia by injections of suitable solutions into the rectum. He points out that the procedure is simple but fraught with danger and therefore should be restricted to the expert anesthetist. For example, ether may be given by rectum when olive oil or oxygen is used as the vehicle if care is taken to avoid an overdose. This method is of recent introduction.

Oxygen-ether vapor per rectum has been used intermittently for

[178] Lasch, W., Über die Bedeutung und den Wert von Nährklistieren beim Säugling," *Klin. Wchnschr.*, Vol. 1, 1922, p. 1936.

[179] Soper, H. W., " The Enema & Colonic Lavage," *Arch. Phys. Therapy, X-ray and Radium*, Vol. 15, 1934, p. 487.

[180] Murphy, J. B., " Perforative Peritonitis, General, Free, Suppurative," *Surg. Gynec. & Obst.*, June, 1908.

[181] Flagg, P. J., *The Art of Anaesthesia*, J. B. Lippincott & Co., Philadelphia and London, 1932, p. 169.

about the last 15 years. Its chief value is in the maintenance of anesthesia otherwise induced. Flagg directs attention to some of the advantages of rectal anesthesia, one of which is the possibility of the introduction of the anesthetic while the patient is still in bed. Furthermore, the apparatus is simple and economical. On the other hand, the disadvantages include its danger and unreliability even in experienced hands. Moreover, the addition of an anesthetic by mouth superimposed upon that in situ in the rectum is more than ordinarily dangerous since there is no way of knowing exactly what part of the latter will be suddenly absorbed. In addition, distention of the rectum is proven to occur. Many other objections and contraindications are discussed.

In the " American Year Book of Anesthesia and Analgesia " published in 1916 Gwathmey [182] writes a thorough chapter on rectal anesthesia going into its historical evolution as well as many other of its interesting aspects. He has also written a book on the subject of Anesthesia.[183] Hewitt's book on " Anesthetics and their Administration " [184] is one of the earlier texts. There are many such.

9. *Rectal Medication.*

We have already made reference to rectal medication in the historical past. At a later period, 1878, Bodenhamer [185] who has described this part of the anatomy so thoroughly, pointed out that rectal medication is not new but on the contrary, is as old as clysters themselves. The rectum is an important channel of administering medications and its value depends on the degree of absorption. However, he believes that it has seldom been practiced except in diseases of the organ itself or in cases in which it is impossible to

[182] McMechen, F. H., *The American Year-Book of Anesthesia & Analgesia,* Surgery Publishing Co., New York, 1916, p. 182. Chapter on Ether-Oil Colonic Anesthesia. Historical Evolution of Rectal Anesthesia, etc., by J. T. Gwathmey, New York.

[183] Gwathmey, J. T., *Anesthesia,* 2nd Ed., Macmillan & Co., New York and London, 1924.

[184] Hewitt, F. W., *Anesthetics & Their Administration,* Macmillan & Co., London and New York, 1907.

[185] Bodenhamer, Wm., *An Essay on Rectal Medication,* New York, Wm. Wood & Co., 1878.

give remedies by mouth and in such instances it is highly beneficial and of great value for treatment may thus be administered in the form of enemas, suppositories as well as by means of galvanic currents. More recently the rectal administration of medicines in capsule form has been practiced. The tolerance of the rectum with regard to irritation and rapid distention must always be kept in mind. There is no question that a number of medicated fluids may be given in this manner, but there is good reason to doubt the latitude of medication recommended in some of the more modern texts, especially amongst those who thoroughly approve of colonic irrigations and their value. In their favor, however, it may be said that even Bodenhamer believed the rectum possessed all the requisites more or less for the exercise of absorption and he gives many examples to prove his belief. On the contrary, others doubt the absorptive capabilities of the rectum and furthermore, consider that many of the medicated solutions as well as enemas given per rectum are irritative. It may safely be said that within prescribed limitations and for certain indications the rectum is an ideal as well as a resourceful, channel through which medications may be administered.

10. *The Bougie.*

Finally, a word or two about the bougie which in the past had a much more widespread use than it has today. We have already referred to Sushruta, the Hindu surgeon, who, as early as the fifth century A. D., described not only a rectal speculum but also rectal bougies and various other instruments. Reference has also been made to O'Beirne's publication in 1834 in which he recommended a bougie as the principal means by which to obtain relief from a spasmodic stricture of the lower bowel. O'Beirne also gave instructions concerning its method of application and is said to have popularized the procedure in those days. Paty (1831) also mentioned the usefulness of the bougie under certain circumstances (*loc. cit.*).

Bougies have been and are used in many parts of the body as for example, in the urethra, the throat, the esophagus, the eustachian tube but its use in the rectum, except in cases of strictures and occasionally for symptomatic relief in spasm, is on the wane. A general idea of the history of the catheter and bougie up to the nineteenth cen-

tury may be found in an article written by Brunn [186] in 1927 but except for a rare and sporadic report of modifications of types of rectal bougies the literature on the subject is sparse. It is interesting to note that Lockhart-Mummery [187] to whom we have already referred in another connection, is responsible for a modified form of rectal bougie which he described in an article as recently as 1937. He points out the lack of safety in the use of rigid metal dilators and recommends the use of soft rubber bougies which may be passed through a large rectal speculum or preferably through an operating sigmoidoscope.

This concludes the history of the enema with its additions, improvements and various modifications traced from the earliest days to the present time. As the history of the stomach tube portrays in many ways the gradual advances made in our knowledge of digestive affections, so in like manner does the history of the enema bring to light the rôle of the enema and related procedures in the development of our knowledge of rectal and colonic disturbances.

[186] Brunn, W. von, "Von Katheter und Bougie bis zur Wende des 19. Jahrhunderts," *Dermat. Wchnschr.*, Vol. 84, 1927, p. 107.

[187] Lockhart-Mummery, J. P., "Modified Rectal Bougie," *Lancet*, Vol. 1, 1937, p. 874.

FAINTING AND COLLAPSE AS ILLUSTRATED IN ANCIENT INDIAN SCULPTURE

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My attention was first drawn to this scene (Fig. 2) by reading an article on five bas-reliefs of Nagarjunakonda [1] by Dr. B. M. Barua, Professor of Ancient Indian History and Archaeology in the University of Calcutta. He identified the bas-reliefs as illustrating different episodes of one and the same Jataka story called "Maha Unmagga" in Fousilboi's edition (Story No. 546) and "Mahasoddha" in the Siamese. Dr. Barua refers to this particular scene as the "Secret of the Theft" and describes it in the following passage:

"Here, too, the scene of action is laid in a public hall and court of justice. In the centre we see a king seated on the throne with the queen by his side. The king is seen without the diadem on his head and the necklace round his neck. A woman is seen explaining in a standing posture something to the king from one side of the throne. Behind and around her are to be noticed four men, dressed alike, one seated on a MORHA and three anxiously looking away in standing posture. On the left, by the side of the throne, a woman remains standing up with a water-jug, while on the floor, just in front of the throne, are shown a basket and two small potlike objects, one placed over the other."

The underlying story may be related thus. The four councillors of the royal court of Videha grew jealous of Mahosada, and con-

[1] Nagarjunakonda or the hill named after the great Buddhist divine, Nagarjuna, is an offshoot on the Eastern Ghats on the Southern Bank of Kistna, in Guntur District, India. The plain or valley adjoining the hill was recently discovered to be a remarkable site of ancient Buddhist culture and learning of the 1st to 3rd centuries and within the last decade, many valuable historic and artistic relics have been unearthed in this locality.

(For authoritative details and description of the site and large number of finds, see Longhurst's monograph on Nagarjunakonda, published by the Archaeological Survey of the Government of India, 1938.)

ceived a plan of getting rid of him. Senaka managed to steal the jewel from the royal crest. Pukkusa took his golden necklace Kavinda, his woollen robe, and Devinda, his golden slipper. Each of them managed to have his thing sent as a present to Amara, Mahosadha's newly married wife, without his knowledge. The jewel was put in a pot of dates carried by a slave girl; the necklace in a casket of jasmine flowers; the robe in a basket of vegetables; and the slipper in a bundle of straw. Amara was intelligent enough to keep a full record of each present as it came, noting by whom it was stealthily sent. Those men went to the palace, and said, " Why, my lord! Won't you wear your jewelled crest? " " Yes, I will, fetch it." But they could not find the jewel or the other things. Then they informed the king that his four ornaments were in Mahosadha's house, and that he used them. The king was angry, and sent to seize him. Mahosadha escaped out of the city in disguise to the south market town where he plied the potter's trade in a potter's house. Senaka and the other three, hearing that Mahosadha was gone, secretly wrote to Amara, courting an interview. She took four letters, and answered to each that he should come at such a time. When they came, she took them all and the four precious things together, and went to the king's courtyard and there greeting him said: " My lord! the wise Mahosadha is no thief; here are the thieves." Referring to the relief, we have to note that Amara is represented as unravelling the mystery of the incident, accusing the four men behind and around her person and describing the contrivances by which the stolen ornaments were sent to her by a maid with a pot of dates and in a casket of jasmine flowers, a basket of vegetables and a bundle of straw."

A casual glance at the plate without any reference to the attempted identification convinced me clearly that this was a scene portraying the fainting or the illness or the last stages of an important personage. Apart from the unmistakable position and attitude of the royal personage that indicates extreme weakness, or almost a state of collapse and coma, the excitement of anxiety and actions of the other persons suggest the same interpretation. The lady on the couch seems to be supporting her lord with difficulty and at the same time to take some water or medicine into the palm of her hands from

the vessel held by another woman, also in an equally anxious pose. At the end of the couch, a number of persons are keenly watching the changes in the appearance of the man who is ill. At one end of the couch, two men are watching the sky probably noting the time and disposition of the planets. At the other end of the couch, a man probably a priest is sitting in a depressed mood, evidently chanting some incantations, and two women are violently gesticulating, calling either for help or rendering assistance. The scene has produced an instantaneous and unforgettable impression that I was gazing on a bedside scene or deathbed scene, sculptured nearly 1800 years ago by a masterhand.

That the scene is intended to represent a person in one of the stages of fainting fit or swooning, may be clearly confirmed by comparing the scene with another panel from the same district and belonging probably to the same age, illustrating a fainting fit of a queen, in the pictorial representation of another jataka, 'Chaddhanta' jataka (Shuddanta = six tusked). The whole story may be summarised as follows: Bodhisatva in one of his previous births was born as a royal elephant with six tusks. He had two wives one of whom conceived a grouse against her lord. She died and in her next birth was born as a woman and married the king of Benares. She became the favourite. As she harboured feelings of revenge against her former elephant-husband, she pretended to be sick and told her husband that she saw in her dreams a six tusked elephant the possession of whose tusks alone would cure her. A bold hunter received instructions from her, went to the region of Himalayas and dug a pit and caught the elephant. When the hunter attempted to slay the animal, the elephant king learned from the hunter his mission and aided him in sawing off its tusks. As soon as the tusks were cut, the elephant fell down dead. The hunter took the tusks to the queen, who, on receiving them and hearing of the elephant's death was filled with remorse and died of broken heart. The panel (Fig. 1) itself is described in the Bulletin of the Madras Government Museum in the following words. "The king wearing his ornamental head dress is sitting on the throne. The queen is leaning on his lap in swoon or perhaps falling down dead at the sight of the tusks which the hunter is showing her in a round basket. The king is trying to prevent her fall."

A similar scene is carved in one of the Amaravati sculptures

I am very happy to find that the latest and most authoritative monograph on 'Nagarjunakonda' sculptures confirms my early impressions with regard to the identification of the scene. These two panels are identified as 'Mandhathu' jataka. It may be pointed

Fig. 1.

Chaddhanta Jataka—Panel fram a Stupa near Goli (about 200 A. D.).

(Reproduced by kind permission of the Superintendent, Government Museum, Madras)

out here that the story of the king Mandhathu has been a very popular one, among all sects of Buddhists and in Pali as well as Sanskrit Buddhist writings. Its appeal to the people of Java can be imagined by the fact that 20 bas-reliefs of the great Stupa of Barabudur are devoted to the illustration of the story, which is here briefly narrated. In this story, the Bodhisattva was born as the son of Uposatha, one of the kings in the early ages of the world,

when men lived to an extraordinary length of time. He was called Mandhathu, and come to the throne after the death of his father, became a chakravartin monarch, possessed of the Seven Precious Things. After countless years spent as the sole monarch of the earth, he became discontent with his earthly splendour and by the power of the Wheel (cakra-ratna), he, with his suite, went to the heaven of the four great kings. He was received with great honour by the four great kings and was made ruler of that heaven. After some time, he got tired of this heaven and proceeded as before to the Heaven of the Thirty Three, ruled by Sakka (Indra). Mandhathu was given half of his own kingdom by Sakka and the two of them ruled together as equals. Time went on, till the Sakka who received Mandhathu, after the expiry of his term of life, had to depart from heaven and another Sakka appeared in his place. In this way, Mandhathu remained as joint ruler of Trayastrimsa heaven till thirty six Sakkas followed one another. Then, discontent again seized Mandhathu and the thought occurred to him that he would become sole monarch of heaven by killing Sakka. He, however, could not kill Sakka; but with the occurrence of this thought, he himself began to age. And as a human body does not disintegrate in heaven, he fell down to the earth, in a park. The park keeper sent the news of his coming to the royal family; they came and appointed him a resting place in the park and the king lay there in lassitude and weariness. He sent a message to his people emphasizing the impermanence of all earthly and heavenly splendour, and died."

The panels may now be described:

"The panel shows Mandhathu in the royal park after his fall from heaven, and on the eve of his impending death. He is seen reclining on a couch with his feet on the lap of a female figure, probably intended for his chief queen. The king has a wearied look, his eyes are closed and is evidently dying. The queen has a sorrowful look and on either side of the couch are female attendants with anxious countenances, bringing various objects and ministering to the dying monarch. Behind the couch is shown a pavillion in which are other women wailing, striking their breasts with their hands."

Fig. 2.

Mandhathu Jataka—Panel from Nagarjunakonda (100-300 A. D.).

(Reproduced by kind permission of the Director-General of Archaeology. Copyright, Archaeological Survey of India)

Fig. 3.

Mandrathu Jataka—Panel from Nargarjunakonda (100-300 A. D.)

(Reproduced by kind permission of the Director-General of Archaeology. Copyright, Archaeological Survey of India)

The other panel (Fig. 3) is the more detailed of the two. "A king reclining on a couch in a state of extreme lassitude, being supported by a woman, probably his chief queen. Two other ladies, probably two of his queens, are seated on stools at either side of the couch. A person who from his mode of dress, appears to be a Brahmin chaplain, occupies another stool on the left and near him is a young man similarly seated obviously grieving. Female attendants in various attitudes are shown bringing in necessary things and ministering to the sick person. On the upper right hand corner of the composition is shown a portion of the sky with a crescent moon, a few stars and an indistinguishable object shown as if it is falling towards the earth. A man and a woman among the persons standing in the background, are pointing towards the sky, obviously drawing attention to the indistinguishable object. A gate in the background on the left side indicates that the scene was laid outside a palace."

In the light of the Jataka story quoted and the brief descriptive commentary on the central figures in the scene, a further inspection of the panels (Figs. II and III) may make even a critic acknowledge that a master Artist has, in an inspired moment, chiselled and preserved for posterity, a vision of the well-known incident, fainting and collapse of the great King Mandhathu.

DE L'EXCELLENCE ET DE LA SUPÉRIORITÉ DE LA FEMME. OUVRAGE TRADUIT DU LATIN D'AGRIPPA (1486-1535)

Avec les Commentaires de Roétitg, 1801

KATE C. H.-MEAD

From a London dealer has recently come an amusing little book with the above title. It has one hundred and twenty-four pages, and a bright green paper cover. It was originally written in Latin, sometime between 1510 and 1530, and several times translated and republished. This particular translation of Agrippa by Roétitg,[1] was printed in French in 1801, on rough sheets 4 x 8 inches, extolling the beauty, intelligence, saintliness and general superiority of women.

The original text was written in Latin, early in the sixteenth century, by a physician, Heinrich Cornelius Agrippa von Nettesheim, and, having been published without the consent of the Church, it and the author were condemned to the flames for heresies, but, somehow, both escaped.

Agrippa was born in Cologne, Germany, in 1486, and became an ardent Kabbalist [2] in 1510. The members of that sect believed that there are three worlds, a heavenly, an elementary and an intellectual, which correspond to a knowledge of mathematics, medicine and theology or light, wisdom and reason. They also believed in the doctrine of similars, and the contraband science of the occult, and in alchemy and astrology. Among their leaders were that " wisest of fools and most foolish of wise men," Hieronymus Cardanus, 1501-1576, and Trithemius, 1462-1516, whose weird and artificial psychology, according to Baas, was combined with spiritism and only a

[1] Roétitg, according to Sarton and other excellent authorities, was the *pseudonym of François Peyrard*, 1760-1822, a French mathematician. Agrippa also wrote *De occulta philosophia*, and *De vanitate scientiarum et artium atque excellentia Verbi Dei declamatio*, and *De matrimonii sacrimento*. He was three times married and had many children. His life and beliefs have been the subject of biographies by H. Morley, A. Prost, A. Daguet, J. Orsier and others.

[2] For an able discussion of the Qabbalah see Sarton's *Introduction to the History of Science*, Vol. II, p. 879 ff., 366-8, 502. For Agrippa, also pp. 880, 913, 987.

modicum of worldly wisdom.[3] Sarton (p. 880 *loc. cit.*) calls its history "a cross section of Jewish thought."

The Kabbalists revelled in classifying all natural phenomena as emanations from the unseen but anthropomorphic Deity. They found in the Bible, particularly in Genesis, many hidden evidences of these emanations, the intrinsic and mystical theories of which appealed particularly to the oppressed Jews after the twelfth century. Three hundred years before the time of Agrippa, Maimonides, a famous Jewish physician, had forged links between the Kabbalists and Hebrews, as Averroës, the Moor, had connected Kabbalism with the ancient philosophy of Aristotle. In the early sixteenth century, Agrippa set himself to reconcile many of its tenets with those of the Roman Church, but failed to be convincing. Kabbalists believed in the power of light and wisdom and reason, and in the religious importance of certain old Hebrew words. The sixteenth century was an age when scholars were fond of holding long parleys on all subjects such as the superiority of men or of women,[4] and they debated religious texts, sometimes for days.

Although Agrippa was a confirmed mystic and Kabbalist, he became an able and practical German physician, but, like other enthusiasts, he was easily misunderstood because of his much speaking and, as Baas says, he was probably more sinned against than sinning, a victim of his controversial and more practical friends. It would seem, however, that few of his friends were prepared whole-heartedly to endorse his mysticism or his adoration of women. These beliefs, however, appealed strongly to the Regent, Louise of Savoy (d. about 1531), mother of Francis I, and to Margaret of Austria (d. 1530), the ruler of the Netherlands.

There had been sporadic cults of adoration of women ever since Troubadour days,[5] in fact from the earliest dynasties of Egypt certain women were worshipped as goddesses because it was supposed

[3] Baas, Joh. Hermann, *Grundriss der Geschichte der Medicin*, 1876, p. 290.

[4] This essay on the superiority of women was translated into five languages and often republished. Roétitg, in 1801, called it a "sublime treatise," adding in his preface the exclamation, "But O Women! It is not enough that *WE* have demonstrated that you are worth more than men; the whole world must acknowledge this truth!"

[5] See Chaucer's *Book of the Duchess*, and Froissart's *Paradis d'Armour*.

that they had been brought forth and filled with divine essence simply by emanations from the highest of the gods. Imhotep, the first storied physician of Egypt, was said to have been created in this way, and even Alexander the Great was considered by the Kabbalists a child of mystical emanations, created in the form of an anthropomorphic god.

As a young enthusiast, when the monks and priests of the Church were persecuting Agrippa for certain heresies, Maximilian protected him by sending him to London on an embassy to the Court. There again he talked too much about his favorite subjects: mysticism, alchemy, the vanity of learning, the divinity of woman, his disbeliefs in witch-craft and in devils, and he soon became unpopular among the great theologians of England. Quite unceremoniously, therefore, he left England and fled to Pavia, Italy, where he studied medicine. As he finished his medical studies he grew more vociferous, and again he got into trouble with the Church, so that Maximilian advised him to enter the German army for protection, and he was tossed around Europe for a while as a barber surgeon. Then, having studied law intermittently, he went to Metz where he practiced both law and medicine, frequently holding forth against a belief in witches and devils and even against the Inquisition. But, as before, he made so many enemies that he had to flee for safety to Switzerland where he practiced medicine quietly for some time, until something adverse happened, and soon we find him teaching medicine in Lyons, France, where he was appointed a court physician by Louise, the acting Queen of France. But, unfortunately, although he was supposed to be an astrologer and a mystic and a " seer " he failed to foretell a happy future for the Queen or the royal family, and he was somewhat summarily dismissed from the Court. He then went surreptitiously to Grenoble to live with old friends, still clinging to a belief in the superiority of women and their divine origin, despite the defection of both Margaret and Louise.[6] He died in Grenoble in 1535.

Agrippa's little green book on the superiority of women is very

[6] Both Margaret of the Netherlands and Austria and Louise of Savoy and France were so influential in 1529 that they were delegated by Charles V and Francis I to conclude the Peace of Cambrai. This has been called the *Ladies' Peace*, and the road they traveled is still called the *Chemin des Dames*.

amusing. He begins his argument with the creation of the world, and gives a knowing explanation of the intent of the Creator. Thus, he says, God made Adam of earth, but was not satisfied with him. He then created Eve from his own emanations and the purest rays of light. She was so beautiful that He created a Paradise in which she might live like the angels. The description of Eve's shining qualities fills seven chapters of the book. Then come chapters to show the innate modesty as well as cleanliness of all women as is seen in the wealth of hair on their heads to cover their nakedness and the absence of it on their bodies! Men, according to Agrippa, have the earthly characteristics; they become baldheaded early and have such hairy bodies that they are as unclean as animals.[7] Women's bodies, on the contrary, are so clean that they do not soil the water in which they bathe, and even seeds and blood of certain women may engender offspring without the help of men, as was the immaculate conception of the Virgin Mary, and for that reason all children are conscious of a sympathetic attachment to their saintly mothers rather than to their carnal fathers. Agrippa goes even further when, for example, he praises women's excretions, adding that the menstrual blood of women is able to cure fevers, dropsy, biliousness, and vapors; it puts out fires, quiets tempests, nullifies the designs of sorcerers and puts devils to flight!

These chapters are followed by reflections as to the innate medical and mental capabilities of women whose god-like pity and sympathy teach them instinctively how to ease sickness and pain; " in fact," says the author, " women are especially skilful as physicians and surgeons, taught by *emanations* from God rather than from books or universities."

The episode of the apple of Paradise is condoned by Agrippa " because," says he, " God had never told Eve not to pick the fruit of the forbidden tree ";—he had already mentioned the subject to Adam before Eve was born! Therefore, Eve did not sin in eating the apple, being merely the ignorant victim of Adam's cupidity for which God punished all men by commanding their circumcision in baby-hood, as a sign of Adam's crime. Furthermore, the holiness

[7] Men were advised to shave their entire bodies and bathe twice a day! This might be valuable against lice and fleas.

as well as superiority of women is again proved by the fact that Jesus never called himself the son of man, but of God and a woman,[8] and therefore the Deity and Christ alone are pure and sinless men.[9]

Chapters XV to XVIII assure us that women have greater will-power than men; and, to prove it, Agrippa quotes from the Bible stories of Eve humiliating Adam, of Delila getting the better of Samson, of the wife of Job overcoming his devils, of the woman of Cana persuading Jesus to do her will. He finds that Rahab, and Jezebel, and Lot's daughters, and Judith were praised in the Scriptures above men who hitherto, had been supposed to be "good." Every heinous crime in the Bible, says Agrippa, was committed by men, not by women, and not only are women of the Bible rated as angelic creatures, but also such notorious pagan characters as Semiramis and Dido and the Amazons, and many royal women of Greece and Rome whom he considers marvels of morality, (Chap. XXIV). If, on the other hand, says he, (Chap. XX) women do occasionally commit worldly crimes, it is because of their earth-born husbands. He then argues that if women had written books they might have exposed the faults of men and their inefficiency in creative power, "for it is from God, but *through* women that all the arts and sciences and virtues emanate!" The superiority of women being thus conceded all the continents were named for women in as much as women are born to rule not only their husbands but the world! "Woman," says he, "excels man in law, philosophy, dignity, and even in architecture, agriculture, medicine, and horse training!" . . . "It is because of a vicious hereditary custom that women have been deprived of their rights and privileges for thousands of years!"

[8] Sarton (*loc. cit.*, Vol. II, p. 912), tells us that Raymond Lull, 1232-1315, of Majorca and North Africa, a famous mystic, was perhaps the first religious philosopher to advance the theory of the Immaculate Conception of the Virgin Mary.

[9] That theories of autogenous birth were common in the early seventeenth century may be seen from a few lines in *The Bride*, a poem of 1617 by Samuel Rowlands, which, according to Professor Kittredge of Harvard, gives a picture of the English views. The Bride who pretends to have had an autogenous child, nevertheless tells her girl friends not to trust solely to themselves if they wish to have children but to marry a virile man, without expectation of the time

> "When every Crow shall turn to be a Parret,
> And every Starre out-shine the glorious Sunne,
> . . . . . and
> Maides shall be with Childe like Merlin's Mother."

With apologies, and suddenly, Agrippa ceases his eulogies of women, not because there is no more argument needed, but because he hopes that his critics will discuss the subject at greater length.

At least one critic of today puts down the little green book with a sigh for the lost opportunity that was Agrippa's of giving really convincing arguments concerning the intellectual powers of contemporary women. He might have contributed something about the scholarly women whom he knew personally, and have discussed their abilities as doctors and teachers as well as rulers. He might have tried to promote the higher education of women to emulate Margaret of the Netherlands and Louise of France, since he pretended to believe in their natural intuition as well as their spiritual and mental gifts.

Unfortunately, he failed to convince even his own generations that men were inferior to women, and, in fact, men of the XVI century were so sure of their own superiority that they built eleven universities for themselves in what is now the Nazi Germany, and they absolutely closed their lecture halls to women. Whether or not Agrippa convinced contemporary women of their own divine superiority, the fact remains that their matriculation in universities was delayed for three hundred years after his death, and what education they could get was through their own private efforts rather than through divine emanations.

And so we ask, was Heinrich Cornelius Agrippa von Nettesheim joking? Or was he in earnest in advocating a belief in the superiority and eminence of women in the sixteenth century?

THE HUNTER MANUSCRIPT IN THE SUTRO COLLECTION: A CORRECTION

J. M. D. OLMSTED

To the Editor:

I have received from Mr. W. R. Le Fanu, Librarian of the Royal College of Surgeons of England, the following communication in regard to my article in the October issue of the *Bulletin*:

Royal College of Surgeons of England,
Lincoln's Inn Fields,
London, W. C. 2
9th November, 1939

Dear Professor Olmsted,

I have read with great interest your article in the *Bulletin of the History of Medicine*: " A student's notes on John Hunter's course of lectures of 1775." As you kindly wrote to me last May about the notes of John Hunter's lectures in this College Library, of which I was able to send you some details in my letter of 30th May, I am venturing to let you know the result of comparing your paper with our MSS. This College possesses 32 complete or partial copies of students' notes of John Hunter's lectures and 24 of William Hunter's. I have to tell you that it is clear that the notes you describe are of William Hunter's lectures. The majority of our MSS. have been sent out of London on account of the war, but luckily a few copies of William Hunter's lectures are available for comparison. I find that they correspond closely with the Sutro book in arrangement and in containing all the passages you quote, often in the same words.

William Hunter's introductory lectures were published in 1784 (Two introductory lectures delivered by William Hunter to his last course of anatomical lectures at his theatre in Windmill-street as they were left corrected for the Press by himself, 4° London 1784). In this book you will find: p. 3, the introductory definition of anatomy; p. 11, Thales; p. 58, lymphatics

and lacteals; p. 61, the passage about the gravid uterus; p. 84, the definition of " physiology and animal oeconomy." On p. 60 William refers to his brother as " Mr. John Hunter " and I find this form of reference also in the MSS. The distinction between the surgeon (Mr.) and the physician (Dr.) is still absolute in London usage today: John Hunter, member of the Company of Surgeons, was invariably ' Mr.', while ' Dr. Hunter ' can refer only to William, who joined the College of Physicians in 1756.

None of the passages just mentioned occur in John Hunter's lectures, but there are two interesting passages, which you quote, which appear to have been used by both William and John. (i) The reference to " Bark and sea-bathing " (*Bulletin* p. 1000) I find in the William Hunter MSS.; it is also in John Hunter's Works, edited by Palmer 1835, vol. 1, p. 598. (ii) The notice of the graft of the cock's testis into the abdominal cavity of the hen (p. 1001). This was first published by John in his book on the Teeth (Works 1835, vol. 2, p. 56). It does not occur, I believe, in John's lectures but is in the MSS. of William's lectures, in the lecture " on the living principle of the blood." William recounts it as an experiment by ' Mr. John Hunter.' . . .

I hope that you will not mind the liberty I am taking in sending you these details. As this College possesses the most representative collection of notes of the lectures of both the Hunters, I feel that I ought to let you know the facts about them.

Yours sincerely,

(Signed) W. R. Le Fanu
(Librarian)

I have reexamined the manuscript attributed to John Hunter in the Sutro Branch of the California State Library in San Francisco in the light of the above letter, and I am convinced that the identification in the Library's catalogue is erroneous and that the manuscript should be attributed to William. I am greatly obliged to Mr. Le Fanu for communicating to me the evidence which makes this

correction possible. I had noticed the use of the title " Dr." in the manuscript but because I was able to establish correspondence between the subject matter of this manuscript and that of the published lectures of John Hunter, I was not convinced of the invariability of the designation " Dr." for the physician, and " Mr." for the surgeon. For example, William Hunter called himself " Mr." in the newspaper advertisements of his early lectures although he had already obtained the Doctorate in Medicine from Glasgow several years before. Neither the two introductory lectures by William Hunter published in 1784 nor manuscripts of notes taken by students from his lectures are available to me here for comparison, but the parallels adduced by Mr. Le Fanu from the manuscripts which are accessible to him, and which are known to be attributable to William Hunter, leave no room for doubt.

Since the lectures from which the Sutro manuscript notes were taken may therefore be assumed to have been delivered by William at the end of his career rather than by John at the beginning of his, the following points may be noted:

The wording of the passage dealing with the lacteals and placenta shows William's insistence on taking to himself the entire credit for the discoveries relating to these two structures. One would have thought that, since he had made a name for himself as an obstetrician and had, in 1774, published his work on the gravid uterus, he would have devoted more time to the latter subject than he appears to have done. However, this section of the lectures may be missing as it is evident that the Sutro manuscript is not quite complete. Since the work on inflammation was definitely John's, it is no wonder that this subject did not have the full treatment to be found in John's lectures. Finally, John having been taught by William, it is not astonishing that their lectures exhibit correspondences.

From the left: Red Cross Commandant, Mrs. Hamilton Emmons, Colonel Osler, Miss Marion Emmons.

COLONEL WILLIAM OSLER, M. D.

A. B. McKIE *
Lt. Colonel United States Army.

EUGENE P. CAMPBELL †

On Saturday morning, July 20, 1918, Colonel Osler with Mrs. Hamilton Emmons, her daughter Miss Marion Emmons and one of the American Red Cross Commandants visited the American Hospital unit at Sarsbury Court, England. Colonel McKie, then Major McKie, was in command of this unit and after showing Sir William through the improvised hospital he took the accompanying kodak picture of the group.

It was not quite a year since Revere Osler's death and burial in Flanders Field. The local epidemic of encephalitis lethargica was occupying much of his time and epidemic of the influenza was just beginning. His own health was not good and he had lost a great deal of weight. We feel that this picture eloquently tells a portion of the story of this trying period in Sir William's life.

We are indebted to Dr. W. W. Francis [1] for the identity of Dr. Osler's companions in this picture. The above mentioned trip to the south of England is described by Colonel Osler in a letter to General Gorgas, reproduced in The Life of Sir William Osler by Harvey Cushing.[2]

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† Assistant Professor of Epidemiology, Department of Public Health and Preventive Medicine, University of Pennsylvania, Philadelphia.

[1] Dr. W. W. Francis, Librarian of The Osler Library, McGill University, Montreal, Canada.

[2] Cushing, Harvey: The Life of Sir William Osler, Oxford University Press 1926, Vol. 2, page 610.

INFLUENZA IN AMERICA DURING THE SIXTEENTH CENTURY (GUATEMALA: 1523, 1559-62, 1576)

F. WEBSTER McBRYDE *
Department of Geography, The Ohio State University, Columbus, Ohio

Among the few native Indian documents of the New World is a history of the Cakchiquel Indians of highland Guatemala, written in the Cakchiquel dialect during the sixteenth century by one of their own people, a member of the Xahilá family. It was discovered in Guatemala in 1844 by Juan Gavarrete, who made the first study of it;[1] was translated from Cakchiquel into French by the Abbé Brasseur de Bourbourg about the middle of the nineteenth century, under the title *Memorial de Tecpam-Atitlan* (published in Tegucigalpa, 1907-08). Dr. D. G. Brinton translated it into English, and published it as the *Annals of the Cakchiquels* (Philadelphia, 1885).[2] A Spanish translation of Brinton (and the last part from Brasseur), was recently made by J. Antonio Villacorta C., and was published in Guatemala in 1934, under both the above titles, as a volume in the "Biblioteca Goathemala" series. The original manuscript is in the library of the University of Pennsylvania.

In the history of the Cakchiquels, three disastrous, unidentified epidemics are mentioned, the first twenty-five years after the "Great Revolt" of 1498, or in *1523* (an oft-repeated accompaniment of or prelude to the European impact, which here came with Alvarado's conquest in 1524), the second in *1559*, lasting until 1562, and the third in *1576*. (Smallpox is mentioned for the first time in this document in 1564.)

Brasseur suggested that the strange disease was syphilis, while Brinton, an M. D., diagnosed it as measles.[3] The symptoms, how-

* From the introductory material of a thesis "Native Economy of Southwestern Guatemala, and its Natural Background," to be presented in partial fulfillment of the Ph. D. degree in Geography at the University of California, Berkeley.

[1] D. G. Brinton, *Annals of the Cakchiquels*, Philadelphia, 1885, p. 55.

[2] A brief summary of the latter appears in the historical chapter of McBryde's *Solola* (Tulane University, Middle American Research Series, 1933).

[3] Brinton, *op. cit.*, p. 207.

ever, resemble neither, but rather those of the great pandemic of influenza in 1918-19, in that there were fever, coughing, sore and swollen throat and nose, and nosebleed.[4] There were a "lesser" and a "greater" pestilence,[5] the latter of which may have been the so-called "pneumonic" type of influenza appearing in the autumn of 1918, with such fatal complications. The suddenness of seizure, rapidity of spread, and great numbers infected,[6] as well as relative immunity of children[7] and high adult mortality,[8] are also reminiscent of 1918. The statement is made in connection with the 1576 occurrence, that "entire towns died."[9]

Most convincing of all, however, is the fact that, prior to the 1559 epidemic, which was said to have come "from a distance," "six months after the arrival of" a President Royal[10] from Spain, there was an influenza epidemic that ravaged "all of Europe" in 1557, reported in Madrid in August.[11] Hirsch records the disease as occurring in Sicily in July, and Spain in October.[12] The Thomson monograph mentions the same epidemic, characterizing it as mild, and as coming from Asia; it also quotes Stowe's *Annales* to the effect that an epidemic raged in England during the harvest of 1558, with so many stricken, that much of the grain had to be left in the fields.[13]

The 1559 outbreak in Guatemala was described by the Cakchiquel historian as the same "pestilence which had formerly raged among the people" (1523).[14] A 1510 epidemic of influenza was recorded by Hirsch as "generally diffused in Europe."[15]

[4] Villacorta, the Guatemala translator, hazarded a guess "by the symptoms" that in this one instance it may have been "influenza or grippe" (1934, *Notas*, p. 358). When the "nose-bleed sickness" struck again in 1576, however, he accepts without comment Brasseur's interpretation as buboes, and translated it literally. There is no attempt to identify the epidemic of 1523.

[5] Brinton, *op. cit.*, p. 194.

[6] *Ibid.*, p. 171.

[7] *Ibid.*, p. 173.

[8] *Ibid.*, p. 171.

[9] 1934 ed., p. 291.

[10] Brinton, *op. cit.*, p. 194.

[11] W. T. Vaughan, "Influenza," *Amer. Journ. of Hyg.*, July, 1921, p. 7.

[12] August Hirsch, *Handbook of geographical and historical pathology*, Creighton trans., 1883, Vol. I, p. 8.

[13] Thomson, D. and R., *Influenza*, Annals, Pickett-Thomson Res. Lab. Dec., 1933, p. 5.

[14] Brinton, *op cit.*, p. 194.

[15] Hirsch, *op. cit.*, p. 8.

Clinical reports quoted in the Thomson monograph include the following symptoms which are strikingly similar to certain aspects of the sixteenth century American disease: " . . . occasionally even every single individual of that community . . . would be stricken down . . . the rate of spread from one to another being remarkable.[16] . . . whether the case developed into the grave type, or remained benign, epistaxis was a phenomenally common early symptom . . . some degree of nose-bleeding had occurred in over half. . . ." [17] In all three of the early Guatemala epidemics, Spanish marginal notes on the original manuscript of the Cakchiquel Annals call the disease " nosebleed sickness " (" enfermedad de sangre de naríces." Cf. excerpts from the Spanish text).

The severity of the disease in Guatemala as manifested by at least one of the later epidemics (1559) may be accounted for in part by the prior development of high virulence in Europe (1557-1558). The severe nature of the first epidemic, that of 1523, may well have resulted from the fact that it was the first native contact with the disease, where the original form, as it affected the conquerors, might have been so mild as to have escaped mention by the Spanish chroniclers.

Shattuck wrote of influenza in colonial America: " Hirsch says that some of the pandemics did not reach the New World. On the other hand, some of them may have done so in the early days after the discovery of the New World and the fact may not have been recorded. Thus, in 1510, in 1580 and again in 1593, influenza ' was generally diffused in Europe,' and it was precisely during this period that frequent communication with Mexico and with the West Indies was being developed." [18]

Thus, on the basis of symptoms and of parallel occurrence in Europe, and in keeping with Shattuck's suggestion that the disease probably reached the New World early, it has been my conclusion that the Cakchiquel epidemics were influenza, which usually has heretofore been thought of as absent from the Americas until the

[16] Thomson, *op. cit.*, p. 70.

[17] *Ibid.*, p. 72.

[18] Shattuck, G. C., *The Peninsula of Yucatan*, Carnegie Inst. of Washington, 1933, p. 347.

seventeenth century.[19] The detailed account by the Xahilá seems to have entirely escaped the notice of medical historians and to have been wrongly diagnosed by lay writers.[20]

EXCERPTS FROM THE BRINTON TRANSLATION (1885)

p. 171

"No. 127. In the course of the fifth year the pestilence began, O my children. First there was a cough, then the blood was corrupted, and the urine became yellow. The number of deaths at this time was truly terrible.

"On the day 1 Ah there were one cycle [21] and 5 years from the Revolt,[22] and the pestilence spread.[23]

"No. 128. In this year the pestilence spread, and then died our ancestor Diego Juan. On the day 5 Ah war was carried to Panatacat [24] by our ancestor, and then began the spread of the pestilence. Truly the number of deaths among the people was terrible, nor did the people escape from the pestilence.

* * * * * * *

"No. 130. But two days afterward died our father, the Counselor Balam, one of the ancients, O my children. The ancients and the fathers died alike, and the stench was such that men died of it alone. Then perished our fathers and ancestors. Half the people threw themselves into the ravines, and the dogs and foxes lived on the bodies of the men. The fear of death destroyed the old people, and the oldest son of the king died at the same time as his young brother. Thus did we become poor, O my children, and thus did we survive,

[19] *Ibid.*

[20] Besides the two diagnoses mentioned above (p. 1, n. 3) José Milla, in his *Historia de la America Central* (1879, p. XXVIII, n. 2) states that there were two epidemics among the Cakchiquels, 1521 and 1522, which "el cronista Califica de bubas." Both the dates and the diagnosis as buboes are apparently misinterpreted.

[21] 20-year cycle.

[22] Revolt occurred in 1498.

[23] According to the Guatemala edition, p. 256, n. 5, a Spanish marginal note indicates that this was the "nose-bleed sickness." "Enfermedad de sangre de narices, prostración, y llagas."

[24] Escuintepeque, or the modern Escuintla, according to Brasseur de Bourbourg (*Histoire du Mexique*, Vol. II, p. 78, n. 2).

being but a little child—and we were all that remained. Hence the putting aside of our claims.

p. 173

" No. 135. Ahtzalam Hunahpu was the sixth son. He was saved from the plague with our three other ancestors. As for us, we were then little children, and we all escaped, and we saw all the pestilence, O my children.

p. 175

" On the day 11 Ah there were 26 years from the Revolt.

" No. 141. Then was completed one year since our fathers and ancestors died of the plague.

p. 194

" On the day 13 Ah was completed the third cycle since the Revolt was made. The third cycle was completed in the year 1558.

" No. 185. * * *.

" Six months after the arrival of the President at Pangan, began here again the pestilence which had formerly raged among the people. It came from a distance. It was truly terrible when this death was sent among us by the great god. Many families bowed their heads before it. The people were seized with a chill and then a fever; blood issued from the nose; there was a cough, and the throat and nose were swollen, both in the lesser and the greater pestilence. All here were soon attacked. These maladies began, O my children, on the day of the Circumcision, a Monday, and as I was writing, we also were attacked with the disease.

" Diego Ernandez Xahil and Francisco Ernandez Galel Bagahol were Alcaldes in the year 1559.

" The first year of the fourth cycle since the revolt was completed on the day 10 Ah."

(This is the end of the English translation.)

Excerpts from Later Passages in the Guatemala Edition (1934)

(Literal Spanish translation from Brasseur's French text.)

p. 283

"No. 189. (1559) Siete días después de la Pascua aumentó la peste, siendo increíble el número de gente que sucumbieron entre hombres, mujeres y niños. Murieron de ella mi padre, mi madre, mi hermano y mi hermana, saliéndoles la sangre de las narices a todas las gentes atacadas.

"No. 191. Se completó el año sesenta y dos de la revolución, 1560 años, el 7 Aj.

"No. 192. La enfermedad y la muerte continuaron en este año . . . Agosto 1562.

p. 291

"No. 207. (Año 1576) . . . en el mismo mes de septiembre volvió la epidemia de las bubas, que a todos atacó, muriendo pueblos enteros."

(Footnote 53, p. 290: Al margen se lee en castellano: Enfermedad de sangre de narices.)

Acknowledgments: I am indebted to Dr. Karl F. Meyer, of the University of California, Department of Bacteriology, for helpful suggestions regarding the identity of the early epidemics from the symptoms recorded in the Brinton translation; also, to Dr. S. F. Cook, Department of Physiology at the same University, for critically reading the manuscript of this article.

Postscript

Following the writing of the present article, a recent (1938) Carnegie Institute publication entitled *A Medical Survey of the Republic of Guatemala*, by Dr. G. C. Shattuck and associates, has come to my attention. In it (Shattuck, Chapter IV, p. 41) precisely the epidemics described in the above article, with some of the same excerpts, are referred to under the heading "Smallpox."

The date of the first epidemic is given by Shattuck, after Scholes, as 1521, and this date is tied in with the 1520 smallpox outbreak of Mexico. The fact that it was 1523, however, is rather definitely

brought out in the *Annals of the Cakchiquels* in the statements that (p. 194) "the third cycle was completed in the year 1558," which put the starting date (the Revolt) at 60 years earlier, or 1598; that (p. 171) the epidemic began in the fifth year of the second cycle, which meant the 25th year after the Revolt; and that (p. 175) the 26th year after the Revolt was one year after the epidemic began. Confusion regarding all dates mentioned in the *Annals* has resulted from the suggested date of "1596 (?)" given by the translator, Brinton, as the year of the Revolt.[1]

Concerning the first Guatemala epidemic, Shattuck considered it as "highly probable that the major mortality in 1521 was caused by smallpox." Not only are the symptoms, however, unlike those of smallpox, but also the latter disease is specifically mentioned by the Cakchiquel author for the first time as having occurred in epidemic proportions in 1564. (Guatemala edition, p. 285, translated as "la viruela."[2]

Shattuck (1938, p. 44) cites the earliest references to influenza in America by Carter and Hirsch ("probable epidemics" in 1618 and 1627, respectively), with the comment that "because the basis for the diagnosis of influenza is unsatisfactory even today, one can scarcely expect to obtain reliable information about epidemics of this disease which may have existed in Mexico or in Central America in early times." If one studies the evidence, however, as presented in the above article on influenza, it will be seen to favor convincingly an influenza diagnosis for the epidemics described in the Cakchiquel *Annals*.

[1] Shattuck dates the second Guatemala epidemic as 1558, as I also did in my Sololá publication (1933, p. 98), which first brought the *Annals* to his attention.

[2] It should be borne in mind that smallpox was a well recognized disease at that time, and was usually given a definite designation, as "viruela" or "viruelas."

MEDICAL HISTORY IN THE MEDICAL SCHOOLS OF CANADA

HENRY E. SIGERIST

I

In June 1939 I published in this *Bulletin* the results of a survey on *Medical History in the Medical Schools of the United States.** In order to cover the whole North American continent the survey was extended to the medical schools of Canada. The following remarks are based on a questionnaire that was sent to the deans of the Canadian medical schools in the spring of 1939 and on data very kindly supplied by Dr. J. H. Elliott of Toronto.

II

DALHOUSIE UNIVERSITY, Halifax, Nova Scotia

Course: No course in the Medical School, but a course on the *History of Science and Civilization*, three lectures a week for one year, has been given in the University by Prof. Stanley Walker since 1924-1925.

Library: Limited facilities for research in medical history.

Club: None.

Various: The authorities of the School feel that a short course would be appropriate. The question has been considered on several occasions but no action has been taken as yet.

UNIVERSITÉ LAVAL, Quebec, Quebec

Course: A required course of 10 hours is given to students of the 5th year. They are examined in the subject and the attendance is 100 per cent.

Lecturer: The course was given from 1915 on by Prof. Arthur Vallée who died on January 8, 1939. After his death

* Vol. VII, pp. 627-662.

Dr. Sylvio LeBlond, Chef de Clinique Médicale, was appointed Professor of the History of Medicine.

Library: Facilities are available.

Club: None at present but Prof. LeBlond intends to organize one in Quebec.

Various: Prof. LeBlond will insist in his teaching more and more on the History of Canadian Medicine and the History of Medicine in the last fifty years. He will devote his researches to the History of Medicine in Canada and particularly in the Province of Quebec before 1608 and after.

UNIVERSITÉ DE MONTRÉAL, Montreal, Quebec

Course: A 10-hour course is given to students of the 5th year.

Lecturer: The lecturers have been:
1914-1918: Prof. Alphonse Mercier,
1918-1923: Prof. Alexandre St. Pierre,
Since 1924: Prof. Eugène St. Jacques.

Various: There has been a department of the History of Medicine since 1914. The questionnaire was not answered and these data were supplied by Dr. J. H. Elliott.

MCGILL UNIVERSITY, Montreal, Quebec

Course: A nominally required, but practically elective 9-hour course is given to students of the 2nd year. No examinations. Average attendance: 30.

Lecturer: From 1907-1937 the course was given by Sir Andrew Macphail. After his death the Osler Librarian, Dr. W. W. Francis, was appointed Lecturer in the History of Medicine.

Library: Since the Osler Library is at McGill University, research facilities are unusually good.

Club: The *Osler Society*, founded 1921; 40 medical students, elected by the Society from the 2nd-5th years; monthly meetings, at which two or more historical papers are read and discussed; also attended by some alumni and the Osler

Librarian, whose advice is usually sought on the preparation of the papers; an annual dinner meeting, with an outside speaker, at which, besides the members, 50 or more alumni and members of the Faculty are present.

Various: The Department of the History of Medicine was founded in 1907.

QUEEN'S UNIVERSITY, Kingston, Ontario

Course: An elective 23-hour course is given to students of the 4th year. No examination.

Lecturer: Beginning in 1919 Dr. J. C. Connell gave informal talks in the History of Medicine to the final year. From 1927 to 1938 Prof. Thomas Gibson, then Professor of Pharmacology and Therapeutics gave a 15-hour course to the 4th year. In 1938 Dr. Gibson was appointed Professor of the History of Medicine.

Library: Facilities for research inadequate.

Club: None.

Various: Prof. Gibson feels that the course should be made a required course.

UNIVERSITY OF TORONTO, Toronto, Ontario

Course: Required 12-hour courses to 4th, 5th and 6th years. No examinations. Students of the 1st year are given a 60-hour course in the *Relation of Science to Civilization* by Prof. H. Wasteneys and Prof. A. F. Coventry.

Lecturer: The chair of the History of Medicine was founded in 1924 and was held from 1924 to 1931 by Prof. J. F. Fotheringham, C. M. G. who was succeeded in the chair by Prof. J. H. Elliott.

Library: Facilities not adequate for research but there is a good collection of works on history and a creditable collection of the works of many of the masters of medicine in the Library of the Academy of Medicine.

Club: The *Medical Historical Club* is a group of about 15 university men who have met once a month except in the

summer for 20 years. The papers read are filled at the Academy of Medicine.

Various: The Academy of Medicine of Toronto has had for many years an annual Library and Historical Night, the first Tuesday in January.

The undergraduate students' journal, *The University of Toronto Medical Journal*, usually publishes at least one article in medical history or biography.

UNIVERSITY OF WESTERN ONTARIO, London, Ontario

Course: From a letter of the Dean, Dr. F. J. H. Campbell:

"The teaching of the History of Medicine has had a checkered career in this Medical School. When Dr. J. W. Crane was Professor of Pharmacology, he had seminars in Medical History in the fourth year. When Dr. Crane retired as active Professor three years ago, no one was appointed officially to teach Medical History.

Dr. E. Seaborn, in a course in Ethics and Economics in the final year, is incorporating two or three hours on the general periods of Medical History this year, and expects to amplify the course.

There is a feeling, however, on the part of the Faculty, that there should be some amplification and organization of this Department."

Library: Facilities for research are available.

Club: The students' undergraduate *Osler Society* discusses medical history. The London Academy of Medicine have a division of Medical History recently formed.

UNIVERSITY OF MANITOBA, Winnipeg, Manitoba

Course: No regular course but in some departments introductory lectures are devoted to the history of that particular subject. Throughout the year there are other lectures devoted to Medical History, but no specified number and to no specified class.

Lecturer: Various staff members.

Library: Facilities for research are available.

Club: There is a *Medical History Club*. Members are practically all members or ex-members of the Faculty.

Various: There are plans for a regular course.

UNIVERSITY OF ALBERTA, Edmonton, Alberta

Course: A required 32-hour course to 4th and 5th year students. No examinations.

Lecturer: The Department of the History of Medicine was established in 1924 with Dr. Heber C. Jamieson as special lecturer. In 1929 Dr. Jamieson was appointed Professor of the History of Medicine.

Library: Facilities for research fair.

Club: *Jamieson Medical History Club* (Graduates)—four meetings a year, the last in conjunction with the refresher course.

Osler Medical Society (Undergraduates)—Semi-monthly meetings always commence with a paper on some phase of medical history.

There are several medical reporting clubs in Edmonton which usually include a paper on medical history at each monthly meeting during the winter.

A medical history club which publishes a Bulletin is in the city of Calgary.

III

The survey shows that the teaching of medical history is infinitely better organized in Canada than in Great Britain and the other Dominions. It compares very favorably with conditions in the United States. The majority of the medical schools have Departments of the History of Medicine. Regular instruction is given in six schools while the other three schools give incidental lectures or a course on the History of Science and Civilization. Where no regular courses are given the authorities feel that they should be given and plans to organize them are being made. McGill University offers through the Osler Library excellent opportunities for research in medical history, but facilities are also available in Toronto

and several other universities. The Osler Societies at McGill, Western Ontario and Alberta devote part of their activities to medical history, and special medical history societies have been founded at Toronto, Manitoba and Alberta to which must be added the very active Club of the Calgary Associate Clinic. The organization of a society is being considered in Quebec.

There is no doubt that Canada has made an excellent start, as was to be expected in the country of Osler. There is still room for improvements and some of the remarks I made in my previous paper apply to Canada also.

I wish to thank the deans of the Canadian medical schools for the trouble they took in answering my questions, and I am particularly indebted to Dr. J. H. Elliott for his most valuable information.

IV

List of Canadian Teachers of Medical History

COVENTRY, A. F., University of Toronto, Toronto, Ontario
ELLIOTT, J. H., University of Toronto, Toronto, Ontario
FRANCIS, W. W., McGill University, Montreal, Quebec
GIBSON, THOMAS, Queen's University, Kingston, Ontario
JAMIESON, HEBER C., University of Alberta, Edmonton, Alberta
LEBLOND, SYLVIO, Université Laval, Quebec, Quebec
ST. JACQUES, Eugène, Université de Montréal, Montreal, Quebec
SEABORN, E., University of Western Ontario, London, Ontario
WALKER, STANLEY, Dalhousie University, Halifax, Nova Scotia
WASTENEYS, H., University of Toronto, Toronto, Ontario

ANNOUNCEMENTS

American Association of the History of Medicine

Members are reminded that the *Sixteenth Annual Meeting* of the Association will be held in Atlantic City, N. J., on May 6, 1940 beginning at 10 A. M. The Council Meeting will take place on May 5, at 3 P. M.

Members who intend to present papers are requested to communicate with the President, Dr. Esmond R. Long, Henry Phipps Institute, Seventh and Lombard Streets, Philadelphia, Pa., *as soon as possible* and not later than March 15.

News from the Constituent Societies

The *Section of the History of Medicine of the Richmond Academy of Medicine* is holding its annual meeting on February 13. Dr. Russell L. Haden will deliver an address on "Early Microscopes and Early Microscopists."

The *New York Society for Medical History* is holding its first meeting of the year on February 16. Chairman: Dr. Victor Robinson; Speaker: Dr. Claude E. Heaton; Subject: "Medicine in Colonial New York"; Discussion by Albert Deutsch.

Progress in the Teaching of Medical History

The University of Georgia School of Medicine, Augusta, Georgia

The University has recently organized a *Department of the History of Medicine.* The instructor is Dr. Cecilia C. Mettler who is giving two required courses in the *History of Medicine* and an elective course on *Medical Historiography.*

State University of Iowa College of Medicine, Iowa City, Iowa

Beginning in the year 1937-1938 a required course in the History of Medicine was added to the curriculum under the direction of Professor I. H. Pierce of the department of pharmacology. The course covers 20 hours and is given in the third trimester of the senior year.

New York University College of Medicine, New York, N. Y.

Steps are under way to start regular seminars on medical history to be conducted by members of the faculty under the auspices of the William Welch Society.

Tufts College Medical School, Boston, Mass.

Professor Benjamin Spector has been appointed full Professor of the History of Medicine.

THE NATIONAL DENTAL CENTENARY CELEBRATION will be held in Baltimore, Md., on March 18-20, 1940 under the sponsorship of the American Dental Association. The preliminary invitation announces the following features:

"During the mornings one academic and two general sessions will be held. In the academic session universities, colleges, and other educational institutions; foreign, national and state dental bodies, will join in commemorating the founding of the Baltimore College of Dental Surgery, the first dental school. Many of the institutions in this and other countries have already signified their intentions to send representatives. These impressive exercises will concentrate and coordinate the homage paid by other professions and groups to dentistry's contribution to humanity. The general sessions will be addressed by noted speakers from the medical profession and from other walks of life.

The principal attraction of the various activities arranged for the evenings will be an historical drama to be presented at Ford's Theatre. The drama will be a cavalcade of dentistry in the United States, with Horace Hayden as the central and coordinating character. Written and produced by professional men of wide experience and acted by a large and capable cast, the dramatic presentation may be regarded as a notable feature of an eminently inclusive and interesting Celebration.

The division devoted to the historic and the scientific exhibits will demonstrate a century of advancement in the art and science of dentistry. Grouped around a replica of the first dental college, exhibits of the dental colleges, dental organizations, public health institutions and individuals will show the evolution of dental materials, instruments, techniques, research and literature. Already

most of the American schools have accepted invitations to participate. The schools have been assigned specific subjects to which they will devote exclusive attention. Thus if you wish to study the evolution of and the last word in any particular subject, you will find a complete exposition of it by a school which has been outstanding in its work in that field. Never before has the profession had an opportunity to see and study such a comprehensive accumulation of dental matter as that to be shown in this department. The aim will be not only to set forth chronologically the historic for its valuable lessons, but also to provide a complete presentation of the latest developments in dentistry from which the visitors may derive much of practical value.

The Association of Dental Manufacturers will join in the celebration with a complete display of dental equipment showing interesting developments of many kinds of dental equipment as well as the latest achievements in dental manufacture.

The program of Scientific Essays will bring together the outstanding intellects of contemporary dentistry. Only for such a significant occasion as the Dental Centenary would it be possible to draw from all parts of the country such an important group of dental figures. Eighteen sections covering every branch of dentistry will be presided over and addressed by men of international reputation, all chosen because of their known ability to speak authoritatively to the profession upon the subjects assigned them. The fifty-four essayists who have been honored by invitations have accepted in full realization of the importance of the occasion. This division will also include thirty long-reel motion pictures, presenting in black and white or in color a wide variety of dental subjects."

The History Program of the Society of American Bacteriologists

Five years ago, the representative organization of bacteriologists in America appointed a *Committee on Archives* and delegated to it, in addition to the customary collection of Society records, the task of writing or causing to be written a history of the Society. After a survey of the situation, the Committee, consisting of Barnett Cohen, Stanhope Bayne-Jones and H. Joel Conn, found that its man-

date offered a rare opportunity for making a useful contribution to historical research, inasmuch as the history of the Society of American Bacteriologists, in the broad sense, happens to be a major part of the history of the adolescence and maturation of bacteriology in America. The extent of this relationship was well illustrated by Prof. C.-E. A. Winslow at New Haven in 1939 when he reviewed the first forty years of the Society.

Apart from a certain amount of published data, the richest and most valuable sources of information are the older bacteriologists, survivors of the earlier generation of great leaders and practitioners of the science. It is around these as a nucleus that the Archives Committee has drawn a plan for accomplishing its task. The plan may be described as a regional history of bacteriology in the United States and Canada, containing accounts of the developments in each distinctive locality (city, state or group of states).

In order to preserve authentic local backgrounds, each region of bacteriological activity has been assigned to someone familiar with the local developments and acquainted with many of the personalities concerned. The writer is encouraged to prepare his historical sketch in a form suitable for independent publication. At the same time, permission is obtained for the Committee to use the published material in the final collected account. In some instances, the author has been content to accumulate the facts and leave the material to the Committee for final disposition.

The program is being furthered by the initiation of round table discussions of local bacteriological history in the city where the Society holds its annual meeting. The first such discussion was held at New Haven on December 28, 1939, and was highly successful. The second is planned for St. Louis, and the third for Baltimore.

The initial stages of this program have advanced sufficiently to show that it is practicable and has reasonable prospect of being completed in the not distant future. The reports already published *

*1. McFarland, Joseph. The Beginning of Bacteriology in Philadelphia. Bull. Inst. Hist. of Med., 1937, *5*, 148-198.

2. Weaver, George H. The Introduction of Bacteriology into the Medical Curriculum in Chicago. Bull. Soc. Med. Hist., Chicago, 1937, *5*, 1-2.

3. Hektoen, Ludvig. Notes on the History of Bacteriology in Chicago. Bull. Soc. Med. Hist., Chicago, 1937, *5*, 3-21.

and in hand are rich in original source material. It is not difficult to imagine that the completed work will represent a unique and valuable historical document.

It may be of interest to mention also that the modest files of the Society's Archives housed at the Johns Hopkins School of Medicine already contain a number of unique items relating to early bacteriology and bacteriologists in America. The Archivist, Dr. Barnett Cohen, hopes to make these files as comprehensive as possible, and to this end is striving to obtain, before they become dispersed or lost, all possible memorabilia in the form of old letters, books and photographs.

BARNETT COHEN

THE FORTY-FIRST GENERAL MEETING AND THE FORTIETH ANNIVERSARY OF THE SOCIETY OF AMERICAN BACTERIOLOGISTS IN NEW HAVEN, CONNECTICUT, DECEMBER 28-30, 1939

The 41st General Meeting of the Society of American Bacteriologists, held at New Haven, Connecticut under the sponsorship of the Connecticut Valley Branch, marked the 40th anniversary of the founding of the Society at New Haven in 1899.

In addition to the program of scientific papers a special Round Table discussion on the History of Bacteriology was held on the evening of December 28th. Dr. George Blumer, one of the founding members of the Society presided and the following papers were read.

1. Thomas Jonathan Burrill (1839-1916).
   Dr. Charles Thom, U. S. Department of Agriculture, Washington, D. C.
2. History of Bacteriology in the Connecticut Valley.
   Dr. Leo F. Rettger, Department of Bacteriology, Yale University School of Medicine.

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4. Tonney, Fred, O. The Introduction of Bacteriology into the Service of Public Health in Chicago. Bull. Soc. Med. Hist., Chicago, 1937, *5*, 22-33.
5. Stimson, A. M. A Brief History of Bacteriological Investigations of the United States Public Health Service, Supplement 141, Public Health Reports, 1938, pp. 1-83.

3. Early Days of Bacteriology at the Yale Medical School.
   Dr. Charles J. Foote, New Haven, Connecticut.
4. Early Days of Bacteriology in the Connecticut State Department of Health.
   Dr. Walter R. Steiner, Hartford, Connecticut.
5. The Introduction of Vaccination into Connecticut.
   Mr. Morris C. Leikind, Library of Congress, Washington, D. C.

On December 29th at the Annual Dinner, Dr. Karl F. Meyer, Director of the George William Hooper Foundation for Medical Research at the University of California, acted as toastmaster. He delivered an address on the Social Function of Science. Professor C. E. A. Winslow of Yale University recounted the history of the Society of American Bacteriologists in an address entitled, "The First Forty Years."

Following the addresses, 7 charter members were presented with testimonials. These founding members were:

Drs. Charles J. Bartlett; George Blumer; A. R. Ward; H. A. Harding; C. E. A. Winslow; S. C. Prescott; Norman M. Harris.

MORRIS C. LEIKIND

A CARNEGIE FELLOWSHIP IN THE HISTORY OF GRAECO-ROMAN SCIENCE AT THE JOHNS HOPKINS UNIVERSITY

This fellowship, open to candidates who have the degree of Ph. D. in classical languages, will bear an annual stipend of $2,000 for two years. The term of the first incumbent will run from September 1, 1940 to August 31, 1942, and the fellow will be expected by the end of the second year to have completed a piece of research worthy of publication.

Applications should be sent to the Registrar of the University not later than April 1, 1940 and should be accompanied by a transcript of the candidate's postgraduate record, letters of recommendation, and a list of such works as the candidate may have published.

The fellowship is a joint fellowship of the School of Higher Studies and the Institute of the History of Medicine. The selection of the candidate will be made by the Departments of Greek, Latin,

Classical Archaeology, and the Institute of the History of Medicine in coöperation with the American Council of Learned Societies. The University will grant to the fellow remission of all fees in all Schools and Departments and the fellow will be free to use all University facilities and to attend all courses.

This fellowship has been established for the purpose of promoting interest in the literature of Graeco-Roman science and its relation to ancient culture and philosophy in general. Graeco-Roman science, as an integral part of ancient civilization from the study of which it cannot be excluded, has hitherto not had appropriate recognition in philological curricula. The fellowship is consequently meant to provide an opportunity for the study of ancient science as well as for the production of works of research in this field.

The Departments have outlined a program for the progressive development of the history of Graeco-Roman science. This program is flexible enough to allow for special consideration of such subjects of research as the fellow may himself propose. Ordinarily the work to be done would be planned in accordance with the scheme projected, which includes collections of material (especially collections and editions of fragments), terminological studies, preparation of commentaries on special treatises, surveys of certain scientific branches, and finally continuous representation of the different periods of ancient science.

Special emphasis will be laid upon the interrelation and integration of literary and scientific writings and upon the fact that science in antiquity comprises the so-called *humaniora* as well as natural studies.

The whole program of research is outlined with a view to a general history of Graeco-Roman science and especially with a view to the clarification of the Greek scientific outlook rather than merely the scientific detail; such an orientation, it is believed, should be valuable for the general history of thought.

PARIS

Prof. Laignel-Lavastine has accepted the chair of psychiatry at the Ecole de Médecine in Paris and has given his inaugural lecture on November 15, 1939. His successor in the chair of the history of medicine is Prof. Lévi-Valensi.